THE LIBRARY OF THE
UNIVERSITY OF
NORTH CAROLINA

THE COLLECTION OF
NORTH CAROLINIANA

C387
N87c6
v.6

00006768321

This **BOOK** may be kept out **TWO WEEKS ONLY**, and is subject to a fine of **FIVE CENTS** a day thereafter. It is **DUE** on the **DAY** indicated below:

APR 1 0 1959

JUL 22 '69

APR 1 0 '69

Digitized by the Internet Archive
in 2013

http://archive.org/details/waterresourcesof06nort

STATE OF NORTH CAROLINA

BOARD OF CONSERVATION AND DEVELOPMENT

GOVERNOR LUTHER H. HODGES, CHAIRMAN

COMMITTEE ON WATER RESOURCES, INLETS AND COASTAL WATERWAYS

CHAIRMAN — — MILES J. SMITH
VICE CHAIRMAN - CHARLES H. JENKINS
MEMBERS — — SCROOP W. ENLOE, JR.
CECIL MORRIS
LEO H. HARVEY
F. J. BOLING

DEPARTMENT OF CONSERVATION AND DEVELOPMENT

WILLIAM P. SAUNDERS, DIRECTOR

DIVISION OF WATER RESOURCES, INLETS AND COASTAL WATERWAYS

BEVERLY C. SNOW, CHIEF ENGINEER

WATER RESOURCES OF NORTH CAROLINA
FRENCH BROAD RIVER BASIN

RALEIGH
NOVEMBER 1957

C387
N8706
v.6

FOREWORD

This publication comprises Volume VI of a series of eleven volumes containing information regarding water resources of North Carolina. Volumes I to V, inclusive, were published as follows:

I State as a whole, January 1955
II Neuse River Basin, May 1955
III Yadkin-Pee Dee River Basin, August 1955
IV Chowan River Basin, December 1955
V Roanoke River Basin, February 1957

Volumes VII - XI, inclusive, will provide inventories of the Cape Fear, Broad-Catawba, Tar-Pamlico, Hiwassee-Little Tennessee, and Kanawha-Watauga River Basins. Draft of inventory of water resources of the Cape Fear River Basin is substantially completed, and considerable progress on draft of inventory of inventory of water resources of the Broad-Catawba River Basin has been made. When the contemplated series are completed, information pertaining to the entire State except several smaller river basins will be available to assist in the orderly planning and development of the water facilities required for municipal and industrial expansion and for the expansion of the uses of water for agriculture; to guide watershed authorities, basin associations, soil conservation districts, and other agencies concerned with water uses in accomplishing their purposes; and to provide aid to the Board of Water Commissioners of the State of North Carolina created by the 1955 Session of the General Assembly of North Carolina.

It is hoped that this publication will assist in the location, development, and expansion of municipal, industrial, agricultural, and other water supplies, and serve as a guide to the future study of water resources in the French Broad River Basin.

Grateful appreciation is hereby extended to persons who provided material specifically indicated in most of the chapters of this volume and also persons who provided material for this volume as follows:

Corps of Engineers, U. S. Army
Chapters I and XI
The Almanac Publishing Company, Raleigh, N. C.
Chapters I and III
North Carolina State Stream Sanitation Committee
Chapter I
Geological Survey, U. S. Department of the Interior
Chapter VI.

790120

INDEX

		Page
I	DESCRIPTION OF WATERSHED	
	Location and Area	1
	Main Stream and Principal Tributaries	1
	Topography	2
	Geology	2
	Cover and Climate	2
	Population	2
	Industry	3
	Agriculture	4
	Transportation	4
	Mapping	4
	General Information regarding Counties	4
	Avery	4
	Buncombe	5
	Haywood	6
	Henderson	6
	Madison	7
	Mitchell	8
	Transylvania	9
	Watershed Boundary	10
	French Broad River Basin Streams	11 - 26
II	USE OF WATER FOR DOMESTIC AND MUNICIPAL PURPOSES	
	Asheville	27
	Black Mountain	27
	Brevard	27
	Burnsville	27
	Canton	28
	Clyde	28
	Hendersonville	28
	Marshall	29
	Montreat	29
	Ridgecrest	29
	Spruce Pine	29
	Waynesville	30
	Weaverville	30
	Bakersville	30
	Hot Springs	31
	Newland	31
	Asheville	32
	Bakersville	32
	Black Mountain	32
	Brevard	32
	Burnsville	32
	Canton	32
	Clyde	32
	Hendersonville	32
	Hot Springs	33
	Mars Hill	33
	Marshall	33
	Montreat	33
	Newland	33
	Ridgcrest	33

II USE OF WATER FOR DOMESTIC AND MUNICIPAL PURPOSES (Cont.) Page

Spruce Pine 33
Waynesville 34
Weaverville 34
Woodfin Sanitary District 34

III USE OF WATER FOR AGRICULTURE

Data regarding Agricultural Production 35
Basin as a Whole 35
Main stem, French Broad River 35
Pigeon River 35
Nolichucky, North Toe, South Toe, and Cane Rivers 35
Irrigation Permits 35

IV USE OF WATER FOR INDUSTRIAL PURPOSES

Records of Wells 39
Buncombe County 39
Haywood County 39
Henderson County 39
Industrial Surface Water Supplies 39

V USE OF WATER FOR RECREATION AND ELECTRIC POWER

Recreation 41
French Broad River Basin as a Whole 41
Main Stem, French Broad River 41
Pigeon River 41
Nolichucky River 42
Electric Power 42
Main Stem, French Broad River 42
Pigeon River 42
Nolichucky River 42

VI SURFACE WATER

Stream Flow Records
Allen Creek near Hazelwood, Haywood County 43
Beetree Creek near Swannanoa, Buncombe County 43
Cane Creek at Fletcher, Henderson County 44
Cane River near Sioux, Yancey County 44
Big Laurel Creek near Stackhouse, Madison County 45
Boylston Creek near Horseshoe, Henderson County 45
Cataloochee Creek near Cataloochee, Haywood County 46
Catheys Creek near Brevard, Transylvania County 47
Clear Creek near Hendersonville, Henderson County 47
Crab Creek near Penrose, Transylvania County 48
Davidson River near Brevard, Transylvania 48
French Broad River at Asheville, Buncombe County 49
French Broad River at Bent Creek, Buncombe County 50
French Broad River at Blantyre, Transylvania County 51
French Broad River at Calvert, Transylvania County 52
French Broad River at Hot Springs, Madison County 52
French Broad River at Marshall, Madison County 53
French Broad River at Rosman, Transylvania County 54
Hominy Creek at Candler, Buncombe County 55

VI SURFACE WATER (Cont.)

Ivy River near Marshall, Madison County 55
Jonathan Creek near Cove Creek, Haywood County 56
Little River near Penrose, Transylvania County 57
Mills River near Mills River, Henderson County 58
Mud Creek at Naples, Henderson County 58
Nolichucky River at Poplar, Mitchell County 59
North Fork Swannanoa River near Black Mountain, Buncombe Co. 60
North Toe River at Altapass, Mitchell County 61
Pigeon River at Canton, Haywood County 61
Sandymush Creek near Alexander, Buncombe County 63
South Toe River at Newdale, Yancey County 64
Swannanoa River at Biltmore, Buncombe County 65
Lakes, Ponds, and Rivers 65

VII GROUND WATER

Geology and Ground Water 67
Flood-plain Deposits 68
Record of wells in the French Broad River Basin 68

VIII QUALITY OF WATER

Public Water Supplies 70
Chemical Character of Surface Waters 70
Avery Creek 70
Allen Creek 70
Beaver Creek 70
Beetree Creek 71
Bent Creek 71
Big Laurel Creek 71
Big Pine Creek 71
Black Mountain Reservoir 72
Boylston Creek 72
Cane Creek 72
Cane River near Burnsville 72
Cataloochee Creek 73
Cane River near Sioux 73
Catheys Creek 73
Clear Creek 74
Corner Rock Creek 74
Crab Creek 74
Crystal Falls Creek 74
Davidson River 74
French Broad River at Asheville 75
French Broad River at Bent Creek 75
French Broad River at Blantyre 76
French Broad River at Calvert 76
French Broad River at Hot Springs 76
French Broad River at Marshall 77
French Broad River at Horseshoe 77
French Broad River at Roseman 78
Hominy Creek 78
Hunter Creek 78
Ivy River 79
Jonathan Creek 79

VIII QUALITY OF WATER (Cont.)

Kings Creek 79
Little River 79
Martin Creek 80
Mills River 80
Newfound Creek 80
Mud Creek 81
Nolichucky River 81
North Fork Mills River 81
North Fork Swannanoa River 81
North Toe River 82
Pigeon River at Canton 82
Pigeon River near Hepco 83
Reems Creek near Alexander 83
Reems Creek at Woodfin 83
Reems Creek near Weaverville 83
Richland Creek at Hazelwood 84
Richland Creek at Lake Junaluska 84
Richland Creek at Waynesville 84
Sandymush Creek 84
South Fork Mills River 84
South Toe River 85
Spring Creek 85
Swannanoa River 85
Walkers Branch 86

IX ABATEMENT OF STREAM POLLUTION

French Broad River Basin Pollution Survey Report 87
Sources of Pollution 87
Main Stem, French Broad River, and Tributaries 87
Town of Rosman 87
Toxaway Tanning Company 87
Town of Brevard 87
Transylvania Tanning Company 87
Ecusta Paper Corporation 87
Chipman La Crosse Hosiery Mills Co. 87
Hendersonville 87
Cranston Printworks 88
Biltmore Dairy Farms 88
American Enka Corporation 88
City of Asheville 88
Buncombe County Sanitary Districts 89
Biltmore Forest 90
Gorham Manufacturing Company 90
Weaverville 90
Mars Hill College 90
Hammarlund Manufacturing Co. 90
Marshall 90
Hot Springs 90
Schools 90
Pigeon River and Tributaries 91
Town of Canton 91
Champion Paper & Fibre Co. 91
Clyde 91
Waynesville-Hazelwood-Lake Junaluska 91

IX ABATEMENT OF STREAM POLLUTION (Cont.)

Dayton Rubber Company 92
Schools 92
Nolichucky River and Tributaries 92
Mining Industry 92
Town of Newland 92
Town of Spruce Pine 92
Town of Burnsville 92
Town of Bakersville 92
Robinson Dairy 92
High Schools 92
Other Contents of the Report 93
Action by the State Stream Sanitation Committee 93

X WATERSHED MANAGEMENT

General 94
Soil Conservation Practices Accomplished and Contemplated 94-5-6
Watershed Protection and Flood Prevention 94

XI NAVIGATION AND FLOOD CONTROL

Examinations and Surveys 97
House Document 1071, 62nd Congress, 3d Session 97
House Document 319, 67th Congress, 2d Session 97
House Document 463, 69th Congress, 1st Session 98
House Document 185, 70th Congress, 1st Session 100
Other Examinations and Surveys 100
Flood Control Plan for the French Broad Valley 100
General Information 101
The Flood Control Plan 102
Costs and Benefits 102
Operation of the System 102
Alternative Plans 103
Acquisition of Land 104
Local Cooperation Required 104

CHAPTER I - - DESCRIPTION OF WATERSHED

Location and Area - - The French Broad River Basin, located in the western part of North Carolina, extends entirely across the State from South Carolina to Tennessee. The basin is drained by the French Broad River, located in the central part, the Pigeon River in the southern part, and the Nolichucky, Cane, and Toe Rivers in the northern part. It has an average width of about 50 miles, an average length of approximately 65 miles, and covers a drainage area of 2,825 square miles. The basin includes all of Transylvania, Henderson, Haywood, Buncombe, Madison, Yancey, and Mitchell counties, and a part of Avery County. It is bounded on the east by the Broad and Catawba River Basin, and on the west by the Little Tennessee River Basin.

Main Stream and Principal Tributaries - The French Broad River, formed by the confluence of the North and West Forks of the French Broad River in the Town of Rosman, Transylvania County, flows northeasterly in Transylvania County, northeasterly and northerly in Henderson County, northerly across Buncombe County, and northwesterly through Madison County to the North Carolina-Tennessee State Line about four miles northwest of Hot Springs in Madison County. It then flows generally westward in Tennessee for 102 miles to its confluence with the Holston River, to form the Tennessee River near Knoxville. The stream has a rather uniform gradient from its source, elevation 2,100 feet, to Asheville, elevation 1,960 feet, having an average slope of 2 1/3 feet per mile. Below this point, the gradient of the river becomes steeper, the average fall being about 16 feet per mile to the state line, elevation 1,240 feet.

The East and West Forks of Pigeon River rise near Sam Knob Mountain and Tennessee Bald Mountain near the Haywood-Jackson and Haywood-Transylvania County Lines, respectively, and flow generally northward to their confluence, to form the Pigeon River, at Woodrow in Haywood County. The Pigeon River flows northerly to Canton, easterly through Clyde, and thence generally northwesterly in Madison County to Waterville on the North Carolina-Tennessee State Line. Thence, it flows northward and joins the French Broad River about four miles north of Newport. It has a very steep gradient, averaging about 30 feet per mile from Canton to the state line.

The North Toe River originates in the northern part of Avery County about 1.5 miles south of Banner Elk, flows southerly, easterly, and southerly through Avery County, and westward through Spruce Pine to the Mitchell-Yancey County Line about 1.5 miles northwest of Boonford, to form the Toe River.

The South Toe River has its source in the southern part of Yancey County about three miles south of Mt. Mitchell, and flows northward through the eastern part of Yancey County to its confluence with the North Toe River.

The Toe River forms the Mitchell-Yancey County Line from the confluence of the North and South Toe Rivers to the confluence of the Toe and Cane Rivers, which form the Nolichucky River.

The Cane River rises in the southern part of Yancey County near Balsam Gap on the Blue Ridge Parkway, and flows in a generally northerly direction to its confluence with the Toe River.

The Nolichucky River forms the Mitchell-Yancey County Line from its source to the North Carolina-Tennessee State Line at a point about two miles northwest of Flat Top Mountain, elevation 4,716 feet. Thence, the Nolichucky River flows

north, west, and southwest in Tennessee, through Davy Crockett Lake formed by Nolichucky Dam, to its confluence with the French Broad River at the upstream end of Douglas Reservoir, constructed by the Tennessee Valley Authority.

The gradients of the North Toe, South Toe, Toe, Cane, and Nolichucky (in North Carolina) Rivers are similar, the fall from the source of the North Toe River to the point at which the Nolichucky River enters Tennessee being about 1,400 feet in a distance of about 73 miles.

Topography - - The French Broad River Basin is located entirely in the mountain region of North Carolina. It is bounded on the south and east by the Blue Ridge Mountains, on the west by Balsam Mountains and Tennessee Ridge, and on the northern part, or North Carolina-Tennessee State Line, by the Great Smoky Mountains, through which the French Broad, Pigeon, and Nolichucky Rivers enter Tennessee. Included in the basin are the New Found Mountains, Pisgah Ridge, Black Mountains, Bald Mountains, and other lesser ranges. The highest elevation in the basin is attained at Mount Mitchell, elevation 6,684 feet, which is located about 20 miles northeast of Asheville and has the distinction of being the highest peak east of the Rocky Mountains. The entire basin area is everywhere mountainous, but the topography is characterized by lower mountains, or hills and valley land lying between the higher ranges. The average elevation of the entire area is probably between 2,500 and 3,000 feet.

Geology - Most of the area of the French Broad River Basin is covered by Pre-Cambrian granite, gneiss, and biotite schist formations. In the lower or southern part of the basin, there is a small area of Palaeozoic carboniferous granite. Along the upper or northwestern boundary, there is a belt of Cambrian quartzites and slates. There are two well defined fault lines running in a northeast-southwest direction across the upper and lower part of the basin.

There is a great variety of mineral deposits of commercial importance found in the basin. One area in Yancey, Mitchell, and Avery Counties, in the northwestern corner of the basin, contains 81 commerically-worked deposits, including mica, feldspar, asbestos, silica, kaolin, talc, and soapstone. In addition to these, there are deposits of limestone, kyanite, lime, gold, manganese, granite, sand, and gravels throughout the rest of the basin.

Cover and Climate - Approximately 66 per cent of the area, covered by the French Broad River Basin, consists of forest land, of which about 44 per cent is farm woodland. A good portion of the remainder of this land is used for woodland pasture.

The mean annual temperature varies between the extremes of 45 and 58 degrees. The northeastern and southwestern portion of the basin have low annual means of about 51 degrees, while the northwestern and southeastern portions have annual means of 58 and 56 degrees, respectively. The lowest annual mean of 45 degrees is around the Mount Mitchell area. The annual mean for the entire basin is approximately 54 degrees.

The mean annual rainfall in the basin varies between the extremes of 40 and 75 inches. Annual rainfall increases generally from 45 inches, in the northwest portion, to 65-70 inches along the southeast boundary. It is interesting to note that the area around Asheville has an annual rainfall as small as any other section of the State (40 inches), while, in the lower part of the basin, the annual rainfall approaches a maximum for the State (75 inches).

Population - During the period 1900-1930, the population of the basin increased from 128,563 to 207,957, or an increase of nearly 62 per cent. In 1900,

the total population was 92 per cent rural, and, in 1930, the rural population had decreased to 74 per cent. This decrease in percentage of rural population may be explained in part by the rapid increase in size of the City of Asheville, the principal city of the basin; and also by the general increase in size of a number of the other municipalities located in the basin.

The population of counties lying wholly or partially within the basin is shown below.

County	1940	1950
Avery	13,561	13,352
Buncombe	108,755	124,403
Haywood	34,804	37,631
Henderson	26,049	30,921
Madison	22,522	20,522
Mitchell	15,980	15,143
Transylvania	12,202	15,194
Yancey	17,202	16,306

The population of municipalities located in the basin is shown below.

Municipality	County	1940	1950
Asheville	Buncombe	51,310	53,000
Brevard	Transylvania	3,061	3,908
Canton	Haywood	5,037	4,906
Hendersonville	Henderson	5,381	6,103
Waynesville	Haywood	2,940	5,295
Bakersville	Mitchell	437	428
Biltmore Forest	Buncombe	476	657
Black Mountain	Buncombe	1,042	1,174
Burnsville	Yancey	997	1,341
Clyde	Haywood	516	598
East Flat Rock	Henderson	1,103	900
Hazelwood	Haywood	1,508	1,769
Jupiter	Buncombe	456	136
Laurel Park	Henderson	171	302
Marshall	Madison	1,160	983
Mars Hill	Madison	517	1,404
Newland	Avery	471	425
Rosman	Transylvania	529	535
Spruce Pine	Mitchell	1,968	2,280
Weaverville	Buncombe	880	1,111

Industry - The number of industrial establishments in the basin decreased from 569 in 1900 to 168 in 1930. This is due in part to the decline in the lumber industry, and also to the tendency of industry towards consolidation. The number of employees increased steadily over the entire period, industry employing 7,752 people in 1930, or 3.7 per cent of the total population. These establishments manufactured products in 1930 valued at approximately 37 million dollars, and paid their employees approximately seven million dollars in wages. Similar figures for 1940 and 1950 are not available.

Lumbering was at one time an important industry in the area. A good deal of the land has been cut over, and this industry declined rapidly during the period 1927 to 1937. The principal types of merchantable timber include oak, hickory, and pine on the lower mountains; and hemlock, birch, maple, oak, poplar, ash, and walnut on the higher mountains. Spruce, balsam, fir, cherry, and maple are found on the

mountain summits. Several large pulp and paper mills are located in the French Broad River Basin.

Agriculture - The principal occupation of the people of the French Broad River Basin is the raising of agricultural products. The soils of the basin are favorably adapted to raising a great variety of crops, including apples, buckwheat, grapes, grasses, Irish and sweet potatoes, vegetables, burley tobacco, corn, clover, rye, wheat, alfalfa, barley, lespedeza, peaches, blackberries, dewberries, vetch, and watermelons.

Transportation - There are no commercial waterways of importance located in this basin. The French Broad River is navigable for a considerable portion of its length, but only for shallow-draft boats; and the amount of commerce carried on by way of this and other rivers is almost negligible.

Piedmont Airlines operate in and through the basin, providing service between Wilmington, North Carolina, and Cincinnati, Ohio, and have an airport at Asheville. According to a 1937 report of the North Carolina State Planning Board, municipal airports are located near Fruitland in Henderson County and near Swannanoa in Buncombe County, and a commercial airport is located near Hendersonville in Henderson County.

The North Carolina Railroad, operated by the Southern Railway System under a 99-year lease, provides service between Goldsboro in Wayne County and Murphy in Cherokee County, through Ridgecrest, Black Mountain, Swannanoa, Asheville, Canton, Clyde, Lake Junaluska, and Waynesville. The Carolina, Clinchfield, and Ohio Railroad serves the upper part of the basin, operating in the valleys of the North Toe, Toe, and Nolichucky Rivers through Altapass, Spruce Pine, Boonford, Toecane, Huntdale, and Poplar.

The principal highways in the basin are as follows:

U. S. 70 - - Ridgecrest - Asheville - Marshall- Walnut - Hot Springs
U. S. 64 - - Bat Cave - Hendersonville - Brevard - Rosman
U. S. 74 - - Bat Cave - Fairview - Asheville
U. S. 19-23 - - Asheville - Canton - Waynesville
U. S. 23 - - Asheville - Weaverville - Mars Hill - Faust.
U. S. 25 - - Hendersonville - Asheville - Marshall - Hot Springs.

Mapping - The Corps of Engineers, U. S. Army, have prepared plan and profile maps of the principal streams in the basin. Topographic maps, published by the U. S. Geological Survey, have been prepared for all of the areas included in the boundaries of the basin. The State Highway and Public Works Commission has prepared highway maps of every county in the State. These maps have two scales, 1 inch equals 1 mile and 1 inch equals 2.65 miles. In addition to locations of highways and municipalities, they show locations of streams, with names to most of them.

General Information Regarding Counties Within or Partially Within the French Broad River Basin.

Avery County - - This county lies in the northwest mountain region and is one of the highest and most rugged counties in the State. It is predominantly rural. Feldspar and mica are produced, and asbestos and iron ore have been mined in the past. The largest deposit of amphibole asbestos occurs 4 miles from Minneapolis, located on a small tributary of the North Toe River and about four miles west of Newland, county seat. Remaining forests contain dead chestnut, oak, and

hemlock. Streams in the French Broad River Basin include the headwaters of the North Toe River, Roaring Creek, and Bushy Creek.

Farming, lumbering, and mining are the chief occupations. There are 55 certified seed potato growers in the county. Vegetables, corn, and potatoes are the leading staples. Some tobacco is raised, and some livestock is produced. Small grain, including oats and buckwheat, is grown. Collection of herbs ("Yarbing") provides off-season income for some persons. The tourist business is substantial.

Communities in the French Broad River Basin include Newland, county seat, Spear, Ingalls, Mt. Pleasant, Plumtree, and Minneapolis.

Rainfall	47.62
Snowfall	39.0
Mean annual temperature	50.50
Growing season (days)	148
Tobacco (1951 Val.)	$119,390
Irish & sweet potatoes (1951 Val.)	$193,950
Corn (1951 Val.)	$128,650
Total Land Area (acres)	158,080
Forest Area (acres)	99,400
Total Tax Val.	$5,914,936
Tax Rate	$1.98

Buncombe County - - A central mountain county, Buncombe is hilly, containing some of the Blue Ridge Mountains and some of the New Found Mountains. Much of the area lies on a plateau west of the Blue Ridge Mountains. Minerals include corundum, limestone, kyanite, vermilulite, serpentine, gneissic granite, and chromite. Forests contain dead chestnut, yellow pine, and poplar. Streams include the French Broad, Swannanoa, and Ivy Rivers and a large number of tributary creeks and branches.

It is a progressive, agricultural county. Nearly one-fourth of the farm income is derived from dairy products. Other farm-income sources are vegetables, corn, hay, and forage. Apples are grown. Poultry is fairly important. Some burley tobacco is grown, and Asheville has a burley auction market. Handicraft production is a substantial business. Textile, novelty, tanning, lumbering, and industries closely concerned with serving transients are listed. Asheville is known internationally as a center of mountain resort activities. Enka has a large plant for making rayon from spruce pulp.

The Farmers Federation, a mountain farm cooperative, is located at Asheville. Public institutions include the Western North Carolina Tubercular Sanitorium at Black Mountain, the Veterans' Hospital at Oteen, and the Veterans' Administration Tuberculosis Hospital at Swannanoa. Colleges include Black Mountain, St. Genevive of the Pines, Asheville-Biltmore Junior, Montreat, and Warren Wilson Vocational Junior Colleges.

Small-mouth bass and a few muskellunge are found in portions of the French Broad River; small-mouth bass, bream, and crappie, in Lake Craig, a municipal lake on the Swannanoa River near its confluence with the French Broad River in Asheville; small mouth bass, in other portions of the Swannanoa River; and bass and bream in Lake Louise on Reems Creek in Weaverville. Other lakes include Lake Kenilworth, Beaver Lake, Lake Ashnoca, and Enka Lake in Asheville, and smaller lakes (names unknown) in Asheville, Swannanoa, Grovemont, Black Mountain, and Ridgecrest.

Rainfall (inches)	38.47
Snowfall (inches)	10.9
Mean annual temperature	55.50
Growing season (days)	194
Corn (1951 Val.)	$969,740
Tobacco (1951 Val.) est.	$1,873,010
Poultry (1951 Val.) est.	$1,350,000
Total Land Area (acres)	413,440
Forest Area (acres)	288,700
Total Tax Val.	$140.795,647
Tax rate	$1.70

Haywood County - - Haywood is a high, mountainous county in western North Carolina with many fertile valleys. It borders, on the northwest, the Great Smoky Mountains National Park. The minerals found in this county are kaolin, clay, mica, lowgrade copper ore, and kynnite. The merchantable species of trees are dead chestnut, oak, hemlock, and poplar. Waters include the Pigeon and Catalooche Rivers, numerous creeks, and artificial lakes. The lakes include Waterville Lake, with a hydroelectric plant, on the Pigeon River about nine miles north of Waynesville; Lake Junaluska on Factor Branch, a tributary of Pigeon River, about four miles southeast of Waynesville. Lake Junaluska Methodist Assembly, summer recreation and educational center, is built around the beautiful 250-acre lake, at which boating, swimming, and fishing are available.

All types of vegetables, fruits, and grains are grown. The largest, privately-owned commercial apple orchards east of the Mississippi River are located near Waynesville. The County is a leader in dairying, and a great number of fine beef cattle are grazed. Small grains, burley tobacco, and potatoes are important. The Champion Paper and Fibre Company on the Pigeon River at Canton is one of the largest paper mills in the world. Furniture factories and many sawmills are located near Waynesville and Canton, and there is a large rubber plant at Hazelwood. Other industries include manufacturing of leather products, cotton textiles, inlaid woods, and food products.

Trout and bass are found in Pigeon River and its tributaries. Cataloochee Creek near Waynesville is noted for trout fishing. Trout fishing is also good in Fines and Jonathan Creeks. A trout hatchery is located near Waynesville.

Communities include Waynesville, county seat, Canton, Hazelwood, Clyde, Lake Junaluska, Dellwood, Maggie, Cruse, and Mt. Sterling.

Rainfall (inches)	46.0
Snowfall (inches)	12.5
Mean annual temperature	54.20
Growing season (days)	171
Tobacco (1952 Val.)	$1,500,000
Beef cattle (1952 Val.)	$2,250,000
Fruits and Vegetables (1952 Val.)	$1,000,000
Total Land Area (acres)	347,520
Forest Area (acres)	209,500
Total Tax Val.	$32,475,409
Tax Rate	$1.55

Henderson County - - A south mountain county, Henderson is high and mountainous with broad, fertile valleys. Chief merchantable species of trees are chestnut, oak, and some pine. Waters include the French Broad, Green, Mills,

and North and South Fork Mills Rivers, and numerous creeks. Three lakes are located near Hendersonville-Oseceola Lake on a tributary of Mud Creek, Highland Lake on King Creek, and Kanuga Lake on a tributary of King Creek. A summer assembly ground, operated by the Episcopal Church, is located at Kanuga Lake. Bonclarken on Highland Lake is the assembly ground for the Associate Reformed Presbyterian Church. Fishing is available as follows: trout in North Fork Mills River, and large-mouth and small-mouth bass and some muskellunge in the French Broad River.

The chief cash crops are vegetables, livestock, and poultry. More apples are shipped out from this county than from any other county in the State. Other large crops are bunch, pole, and lima beans, cabbage, cucumbers, peppers, squash, and sweet corn. Irish and sweet potatoes, small grains, and hay are raised. Dairy products are important. The largest industrial activity comprises textile plants, including cotton, knitting, electric blanket assembly, rugs, and cord. Other industries include plants for canning and freezing fruits and vegetables, lumbering mills, wood, paper and clay products, and a fabric mill. Most of the industry is concentrated in Hendersonville. The tourist trade is important.

Communities include Hendersonville, county seat, East Flat Rock, Balfour, Fletcher, Flat Rock, Dana, Mills River, Laurel Park, Gerton, Brickton, and Hillgirt.

Rainfall (inches)	59.25
Snowfall (inches)	8.6
Mean annual temperature	56.50
Growing season (days)	180
Vegetables (1952 Val.)	$2,780,000
Apples (1952 Val.)	$1,050,000
Dairying (1952 Val.)	$1,080,000
Total Land Area (acres)	224,480
Forest Area (acres)	136,300
Total tax val.	$41,500,000
Tax rate	$1.35

Madison County - - In the western mountains, Madison lies in the Great Smoky Mountains country, bordered on the west by Tennessee. The county is situated in a rich mineral belt, although there is little production now. Barite, coal, corundum, iron ores, magnetite, manganese, and feldspar occur in varrying quantities. Some lenses of high calcium and high magnesium limestone are located near Marshall. Talc is mined near Marshall and Mars Hill. Chief merchantable species of trees are dead chestnut, oak, and yellow pine. Waters include the Ivy and French Broad Rivers, and Big Laurel, Shelton Laurel, Spring, Big Pine, Walnut, Spillcorn, Colvin, Meadow Fork, and other creeks. Small-mouth bass and trout are found in Big Laurel Creek and its tributaries, and muskellunge are found in the French Broad River.

The leading cash crops are burley tobacco, vegetables, and livestock. Madison is second-high in the burley-producing counties. Interest in livestock is increasing. Other crops grown are corn, Irish and sweet potatoes, oats, wheat and hay. There are only a few small-scale industries such as grain mills, a cotton textile mill, and saw mills.

Communities include Marshall, county seat, Hot Springs, Walnut, Spring Creek, Mars Hill, White Rock, Big Pine, Luck, Just, and Paint Rock.

Rainfall (inches)	44.86
Snowfall (inches)	12.4
Mean annual temperature	55.4
Growing season (days)	186
Tobacco (1951 Val.)	$3,587,040
Corn (1951 Val.)	$643,480
Hay (1951 Val.)	$483,960
Total land area (acres)	291,840
Forest area (acres)	139,100
Total tax val.	$10,500,000
Tax rate	$1.65

Mitchell County - - In the northwest mountain section, with an average altitude of 2,500 feet, Mitchell County lies in a region of rugged mountain elevations and unusual mineral wealth. It was named in honor of Dr. Elisha Mitchell, a professor at the University of North Carolina. While on an exploring expedition on Mt. Mitchell, highest peak east of the Rocky Mountains, Dr. Mitchell fell from a high peak and was killed.

The Unaka Mountains and Roan Mountain form western boundaries of the county, with the Blue Ridge Mountains on the eastern edge. The most important producer of mica, feldspar, and kaolin in the United States, the county also has magnetic iron ore, kyanite, marble, and some precious and semi-precious stones. Large deposits of primary kaolin clay occur along the North Toe River from Spruce Pine to Penland. Feldspar and mica also occur in large quantities here. The chief merchantable species of trees are oak, poplar, maple, and hemlock. Waters include the Nolichucky, Toe, and North Toe Rivers, and Bear, Beaver, Cane, Rock, Pigeon Roost, Little Rock, and other creeks. Brown, rainbow, and brook trout are found in Pigeon Roost and Poplar Creeks.

Dairy and beef cattle comprise the largest source of farm income. Hay and tobacco are important crops. Corn, Irish and sweet potatoes and other vegetables, apples, oats, and wheat are also raised. The production of livestock is increasing.

Although mining, chiefly mica, kaolin, and feldspar, is the leading industry, Mitchell also has textile, lumbering, and mica processing plants. At Spruce Pine, grinding plants pulverize feldspar before it is shipped out for use in making glass, chinaware, scouring powder, and other ceramics. Spruce Pine is the center of the only area in the United States producing primary kaolin, used in making fine dinnerware and other high-grade ceramic products. Processing methods have been developed which make the finished product equal to the finest in the world. Roby Buchanan's mill, where native semi-precious stones are cut, polished, and mounted, is located at Hawk.

Penland School of Handicrafts, six miles from Spruce Pine, has become nationally famous. Each summer, hundreds of students from all parts of the United States take courses here in a wide variety of handicrafts under nationally-known instructors. Roan Mountain (6,286 feet and only 398 feet lower than Mt. Mitchell) is an outstanding attraction. Nearly a thousand acres of crimson rhododendron gardens are in bloom there in late June and early July. The mountain, a natural bald, is to be developed by the U. S. Forest Service as a recreational area. A road, extending to the top, provides access from the Blue Ridge Parkway through Spruce Pine and Bakersville.

Communities include Bakersville, county seat, Spruce Pine, Poplar, Buladean, Honeycutt, Forbes, Estatoe, Altapass, Toecane, Bandana, Wing, Penland, Clarissa, and Switzerland.

Rainfall (inches)	51.25
Snowfall (inches)	24.9
Mean annual temperature (degrees)	52.1
Growing season (days)	154
Dairy cattle (1952 Val.)	$350,000
Beef cattle (1952 Val.)	$200,000
Tobacco (1952 Val.)	$300,000
Total land area (acres)	140,800
Forest Area (acres)	78,700
Total Tax Val.	$9,531,734
Tax rate	$1.70

Transylvania County - - In the southern mountain region, with its northwest section covered by Pisgah National Forest, Transylvania is often called "The Land of Waterfalls". Much of the land is in forests and beautiful mountains. In the northeast are beautiful and bountiful mountain valley farmlands, the Davidson and South Fork Mills River Valleys. Near Brevard, there is found a high grade of manganese ore. The southwestern corner of Transylvania County, including Lake Toxaway, Toxaway Falls, and the headwaters of the Toxaway River, lies in the Savannah River Basin. Waters in the county, located in the French Broad River Basin include the French Broad, Davidson, and Little Rivers, the North and West Forks of the French Broad River, Lake Sapphire on a small tributary of the French Broad River near Brevard, Cascade Lake on the Little River near Sheep Mountain, elevation 2,860 feet, and numerous creeks.

A relatively small portion of Transylvania County is in cultivation, but farms produce abundant yields. The chief crop is corn. Other crops produced are vegetables, rye, Irish potatoes, and hay. Livestock growing and dairying are also important. The leading industry in the county is the manufacture of cigarette paper by the Ecusta Paper Corporation near Brevard, which produces most of the paper used by American cigarette manufacturers, as well as fine writing papers. Other industries include lumbering, textiles, leather, and tanning extract.

Brevard College, located at Brevard, is a Junior coeducational college. Numerous summer camps for boys and girls are situated near Brevard. Swimming and boating are available in Brevard. A Red Cross aquatic school is held each August. Fishing is available in the numerous streams in Pisgah National Forest, including Davidson River and South Fork Mills River. In addition, fish are found as follows: Small-mouth bass, rainbow trout, and muskellunge in the French Broad River; rainbow trout in Little River; and trout in Toxaway and Horse Pasture Rivers (Savannah River Basin). Waterfalls in the French Broad River Basin include Connestee Falls on Carson Creek near the Town of Connestee and Looking Glass Falls on Looking Glass Creek in Pisgah National Forest.

Communities include Brevard, county seat, Rosman, Quebec, Connestee, Pisgah Forest, Davidson River, Little River, Blantyre, and Blue Ridge.

Rainfall (inches)	61.23
Snowfall (inches)	9.6
Mean annual temperature	55.4
Growing season (days)	170
Corn (1952 Val.)	$400,000
Bulbs and Flowers (1952 Val.)	$500,000
Dairy Products (1952 Val.)	$100,000
Total Land Area (acres)	242,560
Forest Area (acres)	207,000

Total Tax Val.	$20,152,317
Tax Rate	$1.55

Yancey County - - The Appalachian Range reaches its climax in this county, which has the highest average elevation in North Carolina, as well as the highest point in eastern America (Mt. Mitchell). The topography includes deep valleys, and the range in altitudes, from 2,500 to 6,684 feet, gives the county a variety in climate - cool and pleasant in summer, and severe on the peaks in winter but fairly moderate in sheltered valleys. Most of the forest land is in farm woodlands, though a portion of Pisgah National Forest is in the southern part of the county. The most important species of trees are oak, poplar, pine, hemlock, and balsam. Some of the most productive mica and feldspar mines in the nation have been worked in Yancey County, and there are numerous other minerals, mostly ceramics. The county is drained by the Cane, North Toe, South Toe, Toe, and Nolichucky Rivers, and by many tributaries of these streams.

About one-fourth of the county is in cultivation. The most valuable crops are burley tobacco, corn, and hay. Vegetables, poultry, and livestock are also important, and dairying has expanded very rapidly. Industrial activities include extensive mining operations, especially mica, with approximately 12 processing plants. Much feldspar is mined and processed. The lumber industry is very extensive. Three textile plants, Burnsville Knitting Mill, Glen Raven Silk Mills, Inc., and Duplan Corporation Mill, have recently been built.

Fishing is available as follows: rainbow and brook trout in Murphy and White Oak Creeks, rainbow trout and small-mouth bass in the South Toe River, small mouth bass in the lower section of Cane River to Burnsville, trout in Cane River from Burnsville to Pensacola, and trout fishing for women only in Neel's Creek. The upper waters of Cane River are privately controlled for fishing. There are also other noted trout streams.

Communities include Burnsville, county seat, Celo, Busick, Micaville, Pensacola, Newdale, Windom, Green Mountain, Bald Creek, Ramseytown, Swiss, Bay Book, and Cane River.

Rainfall (inches)	68.70
Snowfall (inches)	44.1
Mean annual temperature	42.6
Growing season (days)	128
Tobacco (1951 Val.)	$1,282,890
Corn (1951 Val.)	$434,080
Hay (1951 Val.)	$290,060
Total Land Area (acres)	199,040
Forest Area (acres)	105,500
Total Tax Val.	$8,537,633
Tax Rate	$1.80

Watershed Boundary - - The boundary line of the French Broad River Watershed, in a clockwise direction, extends generally as follows:

Beginning at Little Hump Mountain on the North Carolina-Tennessee State Line in Avery County about three miles northwest of Minneapolis;

Thence along the ridge through Hump Mountain, Cranberry Gap, Smokey Gap, and Hickory Nut Gap to Linville Gap;

Thence southwest through Pisgah National Forest to the end of a stone-

surfaced road;

Thence, along that road, 4.3 miles to the Town of Montezuma;

Thence southwest and south, through Hawshore Mountain and Three Knobs Mountain, to Three Mile Post Office;

Thence along U. S. Highway 221 to a point on the Avery-McDowell County Line about 0.3 mile northwest of the Town of Linville Falls;

Thence successively along the Avery-McDowell, Mitchell-McDowell, Yancey-McDowell, and Buncombe-McDowell County Lines to Evans Knob Mountain about 1.7 miles southwest of the Town of Ridgecrest in Buncombe County;

Thence generally in a slightly southwesterly direction along the ridge to Little Pisgah Mountain on the Buncombe-Henderson County Line about four miles east of the Town of Fairview in Buncombe County;

Thence along the Buncombe-Henderson County Line through Hickory Nut Gap to a point about 0.3 mile east of Bear Wallow Mountain;

Thence southwest about 2.4 miles to a point on a secondary road about 1.6 miles west of the Town of Bat Cave;

Thence southwest along that road to the Town of Edneyville;

Thence southeast along a paved road 2.2 miles to its intersection with a stone-surfaced road;

Thence generally southwest along this road to the Town of Blueridge;

Thence along paved roads through the Town of Dana to the Town of East Flat Rock;

Thence generally parallel to secondary roads, to Pinnacle Mountain in the southwestern corner of Henderson County;

Thence along the ridge to Standing Stone Mountain at the intersection of the Henderson-Transylvania County Line with the North Carolina-South Carolina State Line;

Thence southwest along the North Carolina-South Carolina State Line to a point about 1.6 miles south of Nancy Mountain in Transylvania County;

Thence along the ridge to Nancy Mountain, and along the ridge between the Toxaway River and the West Fork of the French Broad River to a point on the Jackson-Transylvania County Line about 6.8 miles northwest of the Town of Quebec;

Thence successively along the Jackson-Transylvania, Jackson-Haywood, and Swain-Haywood County Lines to the North Carolina-Tennessee State Line;

Thence generally northeast along the North Carolina-Tennessee State Line to the point of beginning.

<u>French Broad River Basin Streams</u> - - There follows a list, alphabetically arranged, of streams in the French Broad River Basin in North Carolina, the names of which are shown on available maps. There are numerous streams on such maps, the names of which are not indicated. There are shown, on the following

list, the streams into which each of the streams, alphabetically arranged, flows, and also the county in which the junction is located. It is believed that this list will be helpful to interested persons in quickly locating, on a county, topographical, or other map, any stream included in the list and also to trace the course of the stream throughout the basin.

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Adkins Branch	Ivy River	Madison
Aiken Mill Creek	French Broad River	Transylvania
Allen Creek	Richland Creek	Haywood
Allison Creek	French Broad River	Transylvania
Allman Branch	French Broad River	Madison
Anglin Branch	Jackson Creek	Yancey
Anderson Branch	French Broad River	Madison
Ashley Branch	French Broad River	Buncombe
Ashworth Creek	Cane Creek	Buncombe
Assembly Lake	Swannanoa River	Buncombe
Avery Creek	Davidson River	Transylvania
Avery Creek	French Broad River	Buncombe
Bad Creek	Big Rock Creek	Mitchell
Bailey Branch	French Broad River	Madison
Bailey Branch	Jacks Creek	Yancey
Bailey Branch	Pigpen Creek	Yancey
Bald Creek	Cane River	Yancey
Bald Creek	Crabtree Creek	Haywood
Bald Creek	Spring Creek	Madison
Bald Fork	Sandymush Creek	Buncombe
Bald Mountain Creek	Cane River	Yancey
Baker Creek	Cane River	Yancey
Ballard Creek	Cane Creek	Buncombe
Baltimore Branch	Spring Creek	Madison
Banjo Branch	North Toe River	Mitchell
Barnes Branch	Big Creek	Haywood
Barnes Branch	Big Laurel Creek	Madison
Barnett Branch	Big Rock Creek	Mitchell
Bat Fork	Johnson Drainage Ditch	Henderson
Batson Creek	Carson Creek	Transylvania
Baxter Creek	Big Creek	Haywood
Bean Creek	Big Rock Creek	Mitchell
Beantown Creek	Jonathans Creek	Haywood
Bear Branch	Big Laurel Creek	Madison
Bear Branch	Spring Creek	Madison
Bear Creek	French Broad River	Madison
Bear Creek	North Toe River	Mitchell
Bear Creek	Spring Creek	Madison
Bear Rock Creek	South Toe River	Yancey
Bearpen Branch	S. Fork Mills River	Henderson
Bearwallow Brook	S. Fork Mills River	Henderson
Bearwallow Creek	Pigeonroost Creek	Mitchell
Beasley Creek	W. Fork French Broad River	Transylvania
Beaten Branch	Bent Creek	Buncombe
Beaver Creek	North Toe River	Mitchell
Beaverdam Creek	French Broad River	Buncombe
Beaverdam Creek	Pigeon River	Haywood
Bee Branch	Cane River	Yancey

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Bee Branch	E. Fork Pigeon River	Haywood
Bee Branch	North Toe River	Yancey
Bee Branch	Reems Creek	Buncombe
Bee Creek	North Toe River	Yancey
Beech Creek	Big Rock Creek	Mitchell
Beech Nursery Creek	Cane River	Yancey
Beetree Creek	Swannanoa River	Buncombe
Bennett Branch	Caldwell Fork	Haywood
Bennett Branch	E. Fork Pigeon River	Haywood
Bent Creek	Cane River	Yancey
Bent Creek	French Broad River	Buncombe
Bettis Branch	Big Creek	Haywood
Betty Branch	Boylston Creek	Henderson
Bevin Creek	Panther Branch	Buncombe
Big Bearpen Creek	Looking Glass Creek	Transylvania
Big Bearwallow Creek	N. Fork French Broad River	Transylvania
Big Branch	Big Creek	Haywood
Big Branch	E. Fork French Broad River	Transylvania
Big Branch	Little River	Transylvania
Big Branch	North Toe River	Mitchell
Big Branch	Pigeon River	Haywood
Big Creek	Cane River	Yancey
Big Creek	N. Fork Mills River	Henderson
Big Creek	Shelton Laurel Creek	Madison
Big Creek	W. Fork Pigeon River	Haywood
Big Hurricane Creek	Big Laurel Creek	Madison
Big Laurel Creek	French Broad River	Madison
Big Lost Cove Creek	South Toe River	Yancey
Big Mountain Branch	N. Fork French Broad River	Transylvania
Big Pine Creek	French Broad River	Madison
Big Poplar Creek	Cane River	Yancey
Big Rattlesnake Branch	Swannanoa River	Buncombe
Big Rock Creek	North Toe River	Mitchell
Big Spring Branch	Jonathans Creek	Haywood
Big Willow Creek	French Broad River	Henderson
Bill Davenport Branch	North Toe River	Mitchell
Billy Branch	S. Fork Mills River	Henderson
Bird Creek	Pigeonroost Creek	Mitchell
Bird Creek	W. Fork Pigeon River	Haywood
Blackstrap Branch	Ivy River	Madison
Blevins Branch	Big Rock Creek	Mitchell
Blood River	French Broad River	Madison
Bloody Fork	Cane River	Yancey
Blue Branch	French Broad River	Buncombe
Blue Ridge Cove Creek	South Toe River	Yancey
Blue Rock Branch	South Toe River	Yancey
Blue Sea Creek	Beech Nursery Creek	Mitchell
Blythe Branch	Lyday Creek	Transylvania
Blythe Mill Creek	French Broad River	Henderson
Bobs Creek	South Toe River	Yancey
Boring Mill Branch	French Broad River	Buncombe
Bowlens Creek	Cane River	Yancey
Boyd Branch	Bent Creek	Buncombe
Boylston Creek	French Broad River	Henderson
Bradley Creek	E. Fork French Broad River	Transylvania

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Bradley Creek	S. Fork Mills River	Henderson
Brank Cove Branch	Flat Creek	Buncombe
Briar Branch	Swannanoa River	Buncombe
Brightwater Branch	Shaw Creek	Henderson
Britton Creek	Mud Creek	Henderson
Broad Branch	Big Rock Creek	Mitchell
Brock Creek	French Broad River	Henderson
Brooks Branch	Newfound Creek	Buncombe
Brown Branch	Ivy River	Madison
Browning Branch	Richland Creek	Haywood
Browns Creek	South Toe River	Yancey
Browns Mill Creek	French Broad River	Transylvania
Brummett Creek	Big Rock Creek	Mitchell
Brush Creek	Cane Creek	Buncombe
Brush Creek	French Broad River	Madison
Brushy Branch	S. Fork Mills River	Henderson
Brushy Ridge Branch	Catheys Creek	Transylvania
Bryson Creek	French Broad River	Henderson
Bubbling Spring Branch	W. Fork Pigeon River	Haywood
Buckhorn Creek	Little River	Transylvania
Buckner Branch	Big Laurel Creek	Madison
Buckner Branch	Ivy River	Madison
Buffeys Branch	E. Fork French Broad River	Transylvania
Bull Creek	Ivy River	Madison
Bull Creek	Swannanoa River	Buncombe
Burleson Branch	Cane River	Yancey
Burnett Creek	E. Fork Pigeon River	Haywood
Bush Creek	North Toe River	Yancey
Bursted Rock Creek	E. Fork French Broad River	Transylvania
Byers Creek	Mud Creek	Henderson
Byrds Branch	Jacks Creek	Yancey
Caldwell Creek	Spring Creek	Buncombe
Caldwell Fork	Cataloochee Creek	Haywood
California Creek	Ivy River	Buncombe
Camp Branch	Fines Creek	Haywood
Camp Branch	Swannanoa River	Buncombe
Camp Creek	South Toe River	Yancey
Camp Creek	Williamson Creek	Transylvania
Campbell Creek	Jonathans Creek	Haywood
Camp Deerwoode Branch	French Broad River	Transylvania
Camp Illahee Branch	French Broad River	Transylvania
Cane Creek	French Broad River	Henderson
Cane Creek	North Toe River	Mitchell
Cane River	Nolichucky River	Yancey
Caney Bottom Creek	Cove Creek	Henderson
Canie Creek	Hominy Creek	Buncombe
Cantrell Creek	French Broad River	Transylvania
Cantrell Creek	S. Fork Mills River	Henderson
Carpenter Branch	Jonathans Creek	Haywood
Carson Creek	French Broad River	Transylvania
Carter Cove	Beaverdam Creek	Buncombe
Cascade Branch	French Broad River	Buncombe
Cataloochee Creek	Pigeon River	Haywood
Cateechee Branch	French Broad River	Transylvania
Catheys Creek	French Broad River	Transylvania

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Cattail Creek	Cane River	Yancey
Cedar Rock Creek	Davidson River	Henderson
Cedar Rock Creek	French Broad River	Transylvania
Chambers Branch	Pigeon River	Haywood
Charley Branch	Spring Creek	Buncombe
Charlotte Branch	Spring Creek	Buncombe
Cherry Creek	Mud Creek	Henderson
Cherryfield Creek	French Broad River	Transylvania
Chestnut Branch	Big Creek	Haywood
Chestnut Branch	South Toe River	Yancey
Chestnut Creek	Davidson River	Henderson
Chestnut Orchard Branch	Groundhog Creek	Haywood
Christ Branch	North Toe River	Mitchell
Christian Creek	Swannanoa River	Buncombe
Clark Branch	Flat Creek	Buncombe
Clark Branch	Sandymush Creek	Buncombe
Clawhammer Creek	S. Fork Mills River	Henderson
Claypole Branch	N. Fork French Broad River	Transylvania
Clayton Creek	French Broad River	Buncombe
Clear Creek	Mud Creek	Henderson
Clear Creek	Little River	Henderson
Colbert Creek	South Toe River	Yancey
Cold Mountain Branch	E. Fork French Broad River	Transylvania
Cold Springs Creek	Pigeon River	Haywood
Coles Creek	Flat Creek	Buncombe
Connor Mill Branch	Pigeon River	Haywood
Cook Branch	Big Laurel Creek	Buncombe
Corner Rock Creek	Dillingham Creek	Buncombe
Cowper Branch	North Toe River	Mitchell
Counterfeit Branch	Pigeon River	Haywood
Courthouse Creek	N. Fork French Broad River	Transylvania
Cove Creek	Davidson River	Henderson
Cove Creek	Fines Creek	Haywood
Cove Creek	Jonathans Creek	Haywood
Cow Camp Branch	North Toe River	Mitchell
Cox Branch	Little River	Henderson
Crab Creek	Little River	Henderson
Crabtree Creek	Pigeon River	Haywood
Crabtree Creek	North Toe River	Mitchell
Crawford Branch	Boylston Creek	Henderson
Crawford Creek	E. Fork Pigeon River	Haywood
Cub Creek	Cane Creek	Mitchell
Curtis Creek	W. Fork Pigeon River	Haywood
Cushion Creek	Cane Creek	Henderson
Cutshall Branch	Shelton Laurel Creek	Buncombe
Cynthia Branch	Cane River	Yancey
Daniel Ridge Creek	Right Fork Davidson River	Transylvania
Dark Prong	E. Fork Pigeon River	Haywood
Davidson River	French Broad River	Transylvania
Davie Branch	N. Fork Mills River	Transylvania
Davis Branch	French Broad River	Madison
Deer Creek	Big Creek	Haywood
Devils Den	South Toe River	Mitchell
Devils Fork	Mud Creek	Henderson
Diamond Creek	N. Fork French Broad River	Transylvania

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Dick Branch	Flat Creek	Buncombe
Dicks Creek	North Toe River	Mitchell
Dillingham Creek	Ivy River	Madison
Dingle Creek	French Broad River	Buncombe
Dix Creek	Newfound Creek	Buncombe
Dix Creek	E. Fork Pigeon River	Haywood
Dobag Creek	South Toe River	Mitchell
Doe Branch	French Broad River	Madison
Dog Creek	Boylston Creek	Transylvania
Dogwood Flats Creek	Mt. Sterling Creek	Haywood
Dotson Branch	Pigeon River	Haywood
Drab Branch	Bradley Creek	Transylvania
Drift Branch	Richland Creek	Haywood
Dry Branch	E. Fork Pigeon River	Haywood
Dry Branch	Groundhog Creek	Haywood
Ducker Creek	French Broad River	Buncombe
Duckmill Creek	Shelton Laurel Creek	Madison
Duncan Creek	Little River	Transylvania
Dunn Creek	French Broad River	Transylvania
Dunns Creek	Catheys Creek	Transylvania
Dunsmore Cove Branch	Swannanoa River	Buncombe
Dutch Cove Branch	Hominy Creek	Haywood
Eaglenest Branch	Little River	Transylvania
Eaglenest Creek	Richland Creek	Haywood
East Fork	French Broad River	Transylvania
East Fork	Pigeon River	Haywood
Eby Creek	Little River	Transylvania
Edney Branch	Cane River	Yancey
Elk Branch	Cane Creek	Mitchell
Elk Shoal Creek	Cane River	Yancey
Eller Branch	Ivy River	Madison
Ellison Branch	Cane River	Henderson
Emma Branch	Smith Mill Creek	Buncombe
English Branch	North Toe River	Mitchell
English Creek	Jacks Creek	Yancey
Ephraim Branch	Groundhog Creek	Haywood
Eskridge Cove Branch	Swannanoa River	Buncombe
Evans Branch	Jonathans Creek	Haywood
Factor Branch	Richland Creek	Haywood
Fall Creek	Crabtree Creek	Haywood
Falling Water Branch	Cane River	Yancey
Farmer Branch	Richland Creek	Haywood
Fawn Branch	King Creek	Transylvania
Featherston Creek	Mud Creek	Henderson
Feds Branch	Cane River	Yancey
Fie Creek	Jonathans Creek	Haywood
Fines Creek	Pigeon River	Haywood
Flat Branch	Cane River	Mitchell
Flat Branch	Pigeon River	Haywood
Flat Creek	French Broad River	Buncombe
Flat Creek	Swannanoa River	Buncombe
Flat Creek	W. Fork French Broad River	Transylvania
Flat Laurel Creek	W. Fork Pigeon River	Haywood
Flea Branch	Big Laurel Creek	Madison
Fletcher Creek	N. Fork Mills River	Henderson

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Flint Level Branch	French Broad River	Madison
Folly Creek	Little Willow Creek	Henderson
Fork Mountain Branch	North Toe River	Mitchell
Foster Creek	Big Laurel Creek	Madison
Foster Creek	Mills River	Henderson
Four Mile Branch	French Broad River	Buncombe
French Broad River	Tennessee River	Knox (Tenn.)
Friezland Creek	Spring Creek	Madison
Frozen Creek	W. Fork French Broad	Transylvania
Gabriel Creek	Ivy River	Madison
Gaddies Branch	Jonathans Creek	Haywood
Galloway Creek	French Broad River	Transylvania
Gap Creek	Cane Creek	Buncombe
Garden Creek	E. Fork Pigeon River	Haywood
Garren Creek	Cane Creek	Buncombe
Gash Creek	French Broad River	Henderson
Gashes Creek	Swannanoa River	Buncombe
Gaylors Branch	N. Fork French Broad River	Transylvania
George Branch	Hominy Creek	Buncombe
Georgia Branch	Spring Creek	Madison
Gerren Creek	E. Fork French Broad River	Transylvania
Glade Creek	French Broad River	Transylvania
Glady Branch	S. Fork Mills Creek	Henderson
Glady Fork	Catheys Creek	Transylvania
Glady Fork	E. Fork French Broad River	Transylvania
Glen Cove Branch	Swannanoa River	Buncombe
Glover Branch	French Broad River	Madison
Goldmine Branch	Boylston Creek	Henderson
Gouches Branch	Newfound Creek	Buncombe
Graham Creek	Nicholson Creek	Transylvania
Granger Branch	Spring Creek	Madison
Grass Branch	French Broad River	Madison
Grassy Branch	Pigeon River	Haywood
Grassy Creek	Little River	Transylvania
Grassy Creek	North Toe River	Mitchell
Grassy Creek	Swannanoa River	Buncombe
Gravel Creek	Cane River	Buncombe
Gray Camp Branch	Big Creek	Haywood
Greasy Branch	Spring Creek	Madison
Greasy Creek	Big Rock Creek	Mitchell
Greasy Cove Prong	E. Fork Pigeon River	Haywood
Green Creek	W. Fork Pigeon River	Haywood
Greer Creek	Mud Creek	Henderson
Griffin Branch	Brummett Creek	Mitchell
Grogan Creek	Cedar Rock Creek	Transylvania
Groundhog Creek	Pigeon River	Haywood
Guilders Creek	Jacks Creek	Yancey
Gullins Creek	North Toe River	Mitchell
Gumstand Creek	Davidson River	Transylvania
Gunter Branch	Spring Creek	Madison
Gunter Fork	Big Creek	Haywood
Hammett Branch	Bradley Creek	Henderson
Handpole Branch	North Toe River	Mitchell
Haney Creek	Cane River	Yancey
Hannah Branch	South Toe River	Yancey

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Hardscrabble Creek	Cane River	Yancey
Harley Branch	E. Fork Pigeon River	Haywood
Harper Creek	Clear Creek	Henderson
Hart Branch	Little River	Transylvania
Haunty Branch	Frency Broad River	Transylvania
Haw Branch	Dillingham Creek	Madison
Haw Branch	North Toe River	Mitchell
Haw Creek	Swannanoa River	Buncombe
Hawk Creek	Cane River	Yancey
Hawkins Branch	Little River	Transylvania
Hayes Run	French Broad River	Madison
Hemphill Creek	Jonathans Creek	Haywood
Hemphill Creek	South Toe River	Yancey
Henderson Creek	Clear Creek	Henderson
Henry Branch	Avery Creek	Transylvania
Hensley Branch	Shelton Laurel Creek	Madison
Hickory Flat Creek	E. Fork French Broad River	Transylvania
Hickory Fork	Shelton Laurel Creek	Madison
Hickorylog Branch	Shelton Laurel Creek	Madison
Hickorynut Branch	North Toe River	Mitchell
Hicks Branch	Pigeon River	Haywood
Higgins Creek	Cane River	Yancey
High Shoal Branch	Big Laurel Creek	Madison
Hobson Branch	Ivy River	Madison
Hogeye Branch	Sandymush Creek	Buncombe
Hogsed Creek	French Broad River	Transylvania
Hollow Poplar Creek	Cane River	Yancey
Holly Bottom Branch	Pigeon River	Haywood
Hominy Creek	French Broad River	Henderson
Honeycut Branch	Cane Creek	Mitchell
Hooker Creek	Little River	Transylvania
Hooper Creek	Cane Creek	Henderson
Horse Creek	North Toe River	Mitchell
House Branch	Bradley Creek	Henderson
Hungry Creek	E. Fork Pigeon River	Haywood
Hunter Branch	Ivy River	Madison
Hunter Branch	Stevens Creek	Haywood
Hurricane Creek	Pigeon River	Haywood
Hyatt Creek	Richland Creek	Haywood
Indian Camp Branch	Kuykendall Creek	Transylvania
Indian Creek	Jonathans Creek	Haywood
Indian Creek	N. Fork French Broad River	Transylvania
Indian Fork	Cane River	Yancey
Inman Branch	W. Fork Pigeon River	Madison
Ivy River	French Broad River	Madison
Jack Branch	French Broad River	Madison
Jackies Mill Branch	Cane River	Yancey
Jacks Creek	North Toe River	Yancey
Jason Branch	N. Fork French Broad River	Transylvania
Jasperfield Branch	Spring Creek	Madison
Jenkins Branch	French Broad River	Buncombe
Jerry Branch	W. Fork French Broad River	Transylvania
John Branch	Spring Creek	Madison
John Rock Branch	Cedar Rock Creek	Transylvania
Johnson Branch	Shelton Laurel Creek	Buncombe

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Johnson Drainage Ditch	Mud Creek	Henderson
Jonathans Creek	Pigeon River	Madison
Jones Branch	Newfound Creek	Buncombe
Joshua Branch	E. Fork French Broad River	Transylvania
Jumping Creek	S. Fork Mills River	Henderson
Kayle Branch	Catheys Creek	Transylvania
Kelly Branch	French Broad River	Transylvania
Kentucky Creek	North Toe River	Mitchell
Kilby Branch	Big Creek	Buncombe
Killian Branch	Beaverdam Creek	Buncombe
Kimsey Creek	Cane Creek	Henderson
King Creek	Bat Fork	Henderson
King Creek	French Broad River	Transylvania
Kuykendall Creek	Catheys Creek	Transylvania
Kyles Creek	Clear Creek	Henderson
Lake Junaluska	Richland Creek	Haywood
Lamance Creek	N. Fork French Broad River	Transylvania
Lamb Creek	Allison Creek	Transylvania
Lambo Creek	French Broad River	Transylvania
Langford Branch	Cane River	Yancey
Lanning Branch	R. Fork Davidson River	Transylvania
Laurel Branch	Bent Creek	Buncombe
Laurel Branch	Cane River	Yancey
Laurel Branch	Clear Creek	Buncombe
Laurel Branch	E. Fork French Broad River	Transylvania
Laurel Branch	N. Fork French Broad River	Transylvania
Laurel Branch	Pigeon River	Haywood
Laurel Branch	Swannanoa River	Buncombe
Laurel Branch	W. Fork French Broad River	Transylvania
Laurel Branch	W. Fork Pigeon River	Haywood
Laurel Brook	S. Fork Mills River	Henderson
Laurel Creek	Big Creek	Haywood
Laurel Creek	Cane River	Yancey
Laurel Creek	Little River	Transylvania
Laurel Fork	Davidson River	Transylvania
Laurel Fork	Reems Creek	Buncombe
Leatherwood Branch	Fines Creek	Haywood
Ledford Creek	Bent Creek	Buncombe
Lee Creek	French Broad River	Buncombe
Left Prong	South Toe River	Yancey
Lenoir Creek	E. Fork Pigeon River	Haywood
Lewis Branch	Big Laurel Creek	Madison
Licklog Branch	Rocky Fork	Buncombe
Lilly Branch	North Toe River	Mitchel
Limekiln Branch	French Broad River	Transylvania
Line Creek	French Broad River	Buncombe
Liner Creek	Crabtree Creek	Haywood
Linn Cove Creek	Beaverdam Creek	Buncombe
Little Bald Creek	Spring Creek	Madison
Little Bear Creek	North Toe River	Mitchell
Little Bush Creek	North Toe River	Yancey
Little Cataloochee Creek	Cataloochee Creek	Haywood
Little Crabtree Creek	South Toe River	Yancey
Little Creek	Big Laurel Creek	Madison
Little Creek	Cane River	Yancey
Little Creek	Spring Creek	Madison

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Little East Fork	W. Fork Pigeon River	Madison
Little Flat Creek	Flat Creek	Buncombe
Little Henley Branch	Cane River	Yancey
Little Hurricane Creek	Big Laurel Creek	Madison
Little Ivy River	Ivy River	Madison
Little Laurel Branch	North Toe River	Mitchell
Little Laurel Creek	Shelton Laurel Creek	Madison
Little Lost Cove Creek	South Toe River	Yancey
Little Mountain Creek	South Toe River	Yancey
Little Mud Creek	Mud Creek	Henderson
Little Nettle Branch	Big Creek	Haywood
Little Pine Creek	French Broad River	Madison
Little Rattlesnake Branch	Swannanoa River	Buncombe
Little River	French Broad River	Transylvania
Little Rock Creek	Big Rock Creek	Mitchell
Little River	French Broad River	Transylvania
Little Sandymush Creek	Sandymush Creek	Madison
Little Whiteoak Creek	South Toe River	Yancey
Little Willow Creek	French Broad River	Transylvania
Locust Branch	South Toe River	Yancey
Long Branch	Bent Creek	Buncombe
Long Branch	Big Laurel Creek	Madison
Long Branch	Davidson River	Transylvania
Long Branch	E. Fork Pigeon River	Madison
Long Branch	Ivy River	Madison
Long Branch	N. Fork French Broad River	Transylvania
Long Branch	N. Fork Mills River	Transylvania
Long Branch	Pigeon River	Haywood
Long Branch	Pigpen Creek	Yancey
Long Branch	Sandymush Creek	Buncombe
Long Branch	South Toe River	Yancey
Long Mountain Branch	Spring Creek	Madison
Looking Glass Creek	Davidson River	Transylvania
Lost Cove Creek	Cane River	Yancey
Lower Creek	E. Fork French Broad River	Transylvania
Lower Creek	South Toe River	Yancey
Lower Double Creek	Caldwell Fork	Haywood
Low Gap Branch	Big Creek	Haywood
Lydia Creek	French Broad River	Transylvania
Lyddies Creek	Big Rock Creek	Mitchell
Marrow Branch	Pigeon River	Haywood
Marsion Creek	Mill Pond Creek	Henderson
Martin Creek	Fines Creek	Haywood
McDowell Creek	French Broad River	Henderson
McKinney Branch	Boylston Creek	Henderson
McKinney Branch	Ivy River	Madison
McKinney Branch	North Toe River	Yancey
McKinney Branch	Smith Mill Creek	Buncombe
McRay Branch	Little River	Transylvania
McWilliams Branch	Jacks Creek	Yancey
Meadow Fork	Spring Creek	Madison
Medford Cove Branch	Jonathans Creek	Haywood
Medrith Branch	Cane River	Yancey
Meninger Creek	King Creek	Henderson
Merrill Creek	Little River	Transylvania

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Merrill Cove Creek	Cane River	Buncombe
Messer Branch	Teague Branch	Haywood
Middle Creek	E. Fork French Broad River	Transylvania
Middle Fork	French Broad River	Transylvania
Middle Fork	Ivy River	Madison
Middle Prong	W. Fork Pigeon River	Haywood
Mill Branch	W. Fork French Broad River	Transylvania
Mill Creek	French Broad River	Transylvania
Mill Creek	Little River	Transylvania
Mill Creek	Shelton Laurel Creek	Madison
Mill Pond Creek	French Broad River	Henderson
Miller Branch	Brummett Creek	Mitchell
Mill Pond Creek	French Broad River	Henderson
Mills River	French Broad River	Henderson
Mine Branch	Jonathans Creek	Haywood
Mine Branch	King Creek	Transylvania
Mine Branch	South Toe River	Mitchell
Mine Creek	Cane Creek	Mitchell
Mine Fork	Jacks Creek	Yancey
Mitchell Cove Branch	Jonathans Creek	Haywood
Moore Creek	French Broad River	Buncombe
Moore Creek	Hominy Creek	Buncombe
Morgan Creek	Fines Creek	Haywood
Morgan Mill Creek	Peter Weaver Creek	Transylvania
Morrow Branch	Jonathans Creek	Haywood
Moses Branch	Jacks Creek	Yancey
Mossy Branch	Cataloochee Creek	Haywood
Mountain Island Branch	French Broad River	Madison
Mountain Tea Branch	E. Fork French Broad River	Transylvania
Mouse Creek	Big Creek	Haywood
Mt. Sterling Creek	Pigeon River	Haywood
Mud Creek	French Broad River	Henderson
Murray Branch	Boylston Creek	Henderson
Murray Branch	French Broad River	Madison
Murray Branch	Pigeon River	Haywood
Murray Creek	Mud Creek	Henderson
Murphy Branch	South Toe River	Mitchell
Nancy Branch	Reems Creek	Buncombe
Negro Prong	Catheys Creek	Transylvania
Nelson Branch	Cataloochee Creek	Haywood
Nelson Branch	Jonathans Creek	Haywood
Nettle Branch	Big Creek	Haywood
Newfound Creek	French Broad River	Buncombe
Nicholson Creek	French Broad River	Transylvania
Nick Creek	W. Fork Pigeon River	Haywood
Nolen Creek	Richland Creek	Haywood
Nolichucky River	French Broad River	Hamblen (Tenn.)
Norris Branch	Cane River	Mitchell
North Coxe Creek	Cane River	Yancey
North Fork	Big Laurel Creek	Buncombe
North Fork	Big Willow Creek	Henderson
North Fork	French Broad River	Transylvania
North Fork	Ivy River	Buncombe
North Fork	Mills River	Henderson
North Fork	Swannanoa River	Buncombe
North Hominy Creek	Hominy Creek	Haywood

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
North Toe River	Nolichucky River	Mitchell-Yancey
North Turkey Creek	Turkey Creek	Buncombe
Ogle Creek	Sugar Camp Creek	Buncombe
Orchard Branch	Fines Creek	Buncombe
Orchard Branch	King Creek	Transylvania
Orton Branch	French Broad River	Buncombe
Osburn Branch	Boylston Creek	Transylvania
Ox Creek	Reems Creek	Buncombe
Paint Fork	Ivy River	Madison
Painter Branch	Pigeon River	Haywood
Palmer Camp Branch	Big Laurel Creek	Madison
Panhandle Branch	French Broad River	Madison
Panther Branch	French Broad River	Buncombe
Parker Branch	Newfound Creek	Buncombe
Parker Creek	W. Fork French Broad River	Transylvania
Parks Branch	Jonathans Creek	Haywood
Pate Creek	Pigeonroost Creek	Mitchell
Patterson Branch	Newfound Creek	Buncombe
Patterson Creek	French Broad River	Buncombe
Patton Cove Creek	Swannanoa River	Buncombe
Pawpaw Creek	French Broad River	Madison
Paxton Creek	French Broad River	Transylvania
Perry Creek	Shepard Creek	Henderson
Peter Weaver Creek	French Broad River	Transylvania
Phillips Branch	Clear Creek	Henderson
Phillips Branch	Fines Creek	Haywood
Phillips Creek	Hogsed Creek	Transylvania
Phipps Branch	South Toe River	Yancey
Phipps Creek	Cane River	Mitchell
Piedmont Lake Branch	Little River	Transylvania
Pigeon Branch	S. Fork Mills River	Transylvania
Pigeon River	French Broad River	Cocke (Tenn.)
Pigeonroost Creek	North Toe River	Mitchell
Pigpen Creek	North Toe River	Yancey
Pine Branch	Big Laurel Creek	Madison
Pineroot Branch	Big Rock Creek	Yancey
Pine Swamp Creek	Cane River	Mitchell
Pinetree Cove Creek	Jonathans Creek	Haywood
Pinner Creek	Cane Creek	Henderson
Pisgah Creek	E. Fork Pigeon River	Haywood
Plott Creek	Richland Creek	Haywood
Poison Cove Branch	E. Fork Pigeon River	Haywood
Pole Creek	Hominy Creek	Buncombe
Pole Bridge Branch	Little River	Transylvania
Pond Branch	Hominy Creek	Buncombe
Ponder Branch	French Broad River	Madison
Poplar Branch	W. Fork Pigeon River	Haywood
Poplar Creek	S. Fork Mills River	Transylvania
Prophet Branch	Big Creek	Haywood
Pounding Mill Branch	Cane River	Mitchell
Pounding Mill Branch	Looking Glass Creek	Transylvania
Pounding Mills Branch	Queen Creek	Transylvania
Powell Creek	French Broad River	Buncombe
Pump Branch	Big Rock Creek	Yancey
Pump Branch	French Broad River	Madison

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Puncheon Camp Creek	Clear Creek	Henderson
Puncheon Camp Branch	Spring Creek	Madison
Puncheon Fork	Big Laurel Creek	Madison
Queen Creek	S. Fork Mills River	Henderson
Queen Creek	W. Fork Pigeon River	Haywood
Rabbitskin Creek	Pigeon River	Haywood
Racoon Branch	French Broad River	Madison
Racoon Branch	Spring Creek	Madison
Racoon Creek	North Toe River	Buncombe
Ragsdale Creek	Hominy Creek	Buncombe
Ram Branch	Swannanoa River	Buncombe
Raven Fork	Cane River	Yancey
Reasonover Creek	Little River	Transylvania
Rebels Creek	North Toe River	Mitchell
Redbank Creek	Richland Creek	Haywood
Reed Creek	French Broad River	Buncombe
Reems Branch	Ponder Branch	Madison
Reems Creek	French Broad River	Buncombe
Reservoir Branch	Spring Creek	Madison
Revis Branch	Ivy River	Madison
Rice Branch	Beaverdam Creek	Buncombe
Rice Cove Branch	Big Laurel Creek	Madison
Rich Branch	Bent Creek	Buncombe
Richland Creek	Pigeon River	Haywood
Richland Creek	W. Fork French Broad River	Transylvania
Right Fork	Davidson River	Transylvania
Right Fork	Pigeonroost Creek	Mitchell
Roaring Fork	Big Laurel Creek	Madison
Robinson Creek	Cane Creek	Buncombe
Robinson Creek	Sandymush Creek	Buncombe
Rock Branch	Shelton Laurel Creek	Madison
Rock Creek	South Toe River	Yancey
Rockbrook Camp Branch	French Broad River	Transylvania
Rock Hollow Branch	Crabtree Creek	Haywood
Rockhouse Creek	Davidson River	Transylvania
Rocky Branch	Pigeon River	Haywood
Rocky Branch	W. Fork Pigeon River	Haywood
Rocky Cove Branch	Hominy Creek	Haywood
Rocky Fork	Cane Creek	Buncombe
Rocky Fork	N. Fork Mills River	Transylvania
Roddy Branch	Shelton Laurel Creek	Madison
Rogers Branch	Pigeon River	Haywood
Rogers Cove Creek	Crabtree Creek	Haywood
Roland Branch	Cane River	Yancey
Rose Branch	South Toe River	Yancey
Rose Creek	North Toe River	Mitchell
Rose Creek	South Toe River	Yancey
Ross Creek	Swannanoa River	Buncombe
Round Hill Branch	Newfound Creek	Buncombe
Rube Rock Creek	Pigeon River	Haywood
Runyon Creek	Pigeon River	Haywood
Rush Branch	N. Fork Mills River	Transylvania
Rush Fork	Crabtree Creek	Haywood
Sally Haines Branch	Pigeon River	Haywood
Sally Branch	Fines Creek	Haywood

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Sam Branch	W. Fork Pigeon River	Haywood
Sampson Branch	Jacks Creek	Yancey
Sams Branch	Nolichucky River	Mitchell
Sandymush Creek	French Broad River	Buncombe
Sawmill Creek	French Broad River	Transylvania
Schoolpath Branch	W. Fork French Broad River	Transylvania
Searcy Creek	Davidson River	Transylvania
Seng Branch	Cane River	Yancey
Seniard Creek	N. Fork Mills River	Henderson
Setrock Creek	South Toe River	Yancey
Shateen Branch	Cane River	Yancey
Shaw Creek	French Broad River	Henderson
Shelton Branch	Richland Creek	Haywood
Shelton Laurel Creek	Big Laurel Creek	Madison
Shepherd Branch	Flat Creek	Buncombe
Shepherd Creek	Mud Creek	Henderson
Shingle Cove Branch	Richland Creek	Haywood
Shining Creek	E. Fork Pigeon River	Haywood
Shoal Creek	Cane Creek	Buncombe
Shoal Creek	Middle Fork French Broad River	Translyvania
Shoal Creek	N. Fork French Broad River	Transylvania
Shook Branch	Big Laurel Creek	Madison
Shop Branch	Nolichucky River	Mitchell
Shut-in Branch	Davidson River	Transylvania
Shut-in Creek	French Broad River	Madison
Silver Mine Creek	French Broad River	Madison
Simmons Branch	Sandymush Creek	Madison
Sitton Creek	Boylston Creek	Transylvania
Skiffley Creek	Pigeon River	Haywood
Slickrock Creek	Pigeon River	Haywood
Sliding Knob Creek	Spring Creek	Madison
Sluder Creek	Newfound Creek	Buncombe
Smith Creek	French Broad River	Buncombe
Smith Mill Creek	French Broad River	Buncombe
Snow Creek	North Toe River	Madison
Snow Bird Creek	Pigeon River	Haywood
Soapstone Branch	McDowell Creek	Henderson
Sodom Branch	Big Laurel Creek	Madison
South Cox Creek	Jacks Creek	Yancey
South Fork	Big Willow Creek	Henderson
South Fork	Mills River	Henderson
South Hominy Creek	Hominy Creek	Buncombe
South Prong	Little River	Transylvania
South Turkey Creek	Turkey Creek	Buncombe
Spillcorn Creek	Big Laurel Creek	Madison
Spooks Branch	Beaverdam Creek	Buncombe
Spring Creek	Big Rock Creek	Yancey
Spring Creek	French Broad River	Madison
Spring Mountain Branch	Cane Creek	Buncombe
Squirrel Branch	Spring Creek	Madison
Stamey Cove Branch	E. Fork Pigeon River	Haywood
Star Creek	Jacks Creek	Yancey
Starens Branch	Davidson River	Transylvania
Steel Creek	Little River	Transylvania
Steep Creek	Swannanoa River	Buncombe

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Steve Branch	Spring Creek	Madison
Stevens Creek	Pigeon River	Haywood
Stillhouse Branch	Ivy River	Madison
Stillwater Branch	Davidson River	Transylvania
Stinking Camp Branch	Mt. Sterling Creek	Haywood
Stinking Creek	Big Creek	Haywood
Stony Creek	Dillingham Creek	Madison
Stuart Creek	N. Fork Mills River	Henderson
Sugar Camp Branch	Ivy River	Madison
Sugar Camp Branch	Spring Creek	Madison
Sugar Camp Creek	Cane River	Yancey
Sugar Camp Fork	Reems Creek	Buncombe
Sugar Creek	Sandymush Creek	Buncombe
Sugar Creek	Ivy River	Madison
Sugar Cove Branch	Fines Creek	Haywood
Swallow Fork	Big Creek	Haywood
Swannanoa River	French Broad River	Buncombe
Sweeten Creek	Swannanoa River	Buncombe
Sweetwater Branch	Boylston Creek	Henderson
Sweetwater Branch	French Broad River	Madison
Sweetwater Branch	S.Fork Mills River	Henderson
Tarkiln Branch	Catheys Creek	Transylvania
Tarlton Branch	Shelton Laurel Creek	Buncombe
Teague Branch	Pigeon River	Haywood
Thickety Creek	Pigeon River	Haywood
Thompson Creek	S. Fork Mills River	Henderson
Thrash Branch	French Broad River	Transylvania
Three Forks Creek	South Toe River	Yancey
Tillery Branch	French Broad River	Buncombe
Timber Creek	Sugar Camp Creek	Yancey
Tinsley Creek	King Creek	Transylvania
Tom Creek	Little River	Transylvania
Tom Creek	W. Fork Pigeon River	Haywood
Tomahawk Branch	Swannanoa River	Buncombe
Tom Hall Branch	Pigeon River	Haywood
Toms Branch	Fines Creek	Haywood
Town Creek	Dillingham Creek	Buncombe
Trantham Creek	Cane River	Buncombe
Trent Branch	French Broad River	Buncombe
Trent Branch	Hominy Creek	Buncombe
Trudy Creek	Cane River	Yancey
Tucker Creek	Nicholson Creek	Transylvania
Tucker Creek	N. Fork French Broad River	Transylvania
Turkey Creek	Davidson River	Transylvania
Turkey Creek	Fines Creek	Haywood
Turnpike Creek	W. Fork Pigeon River	Haywood
Tweed Creek	Cane Creek	Buncombe
Ugly Creek	E. Fork Pigeon River	Haywood
Upper Creek	E. Fork French Broad River	Transylvania
Upper Creek	South Toe River	Yancey
Upper Double Branch	Caldwell Fork	Yancey
Walker Branch	Dillingham Creek	Buncombe
Walker Creek	Little River	Transylvania
Walnut Creek	French Broad River	Madison
Wash Creek	Mud Creek	Henderson
Wash Creek	N. Fork Mills River	Henderson

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Watermelon Branch	Big Laurel Creek	Madison
Webb Branch	Hominy Creek	Buncombe
Wesley Creek	Fines Creek	Haywood
West Fork	French Broad River	Transylvania
West Fork	Pigeon River	Haywood
Westley Creek	Bent Creek	Buncombe
Whaley Branch	Big Creek	Haywood
White Branch	Flat Creek	Buncombe
White Creek	French Broad River	Buncombe
Whiteoak Branch	Pigeon River	Haywood
Whiteoak Creek	Ivy River	Madison
Whiteoak Creek	Nolichucky River	Yancey
Whiteoak Creek	North Toe River	Mitchell
Whiteoak Creek	South Toe River	Yancey
Whiteside Branch	North Toe River	Mitchell
Whitson Branch	North Toe River	Mitchell
Whittemore Creek	Ivy River	Buncombe
Whittier Branch	French Broad River	Buncombe
Wild Branch	Big Laurel Creek	Madison
Wiles Creek	Big Rock Creek	Mitchell
Wilkins Creek	Pigeon River	Haywood
Williams Branch	Dillingham Creek	Buncombe
Williamson Creek	French Broad River	Transylvania
Willow Creek	Sandymush Creek	Buncombe
Wilson Branch	Big Laurel Creek	Madison
Wilson Branch	Cane River	Mitchell
Wilson Mill Creek	Catheys Creek	Transylvania
Winchester Creek	Richland Creek	Haywood
Winding Stair Branch	Caldwell Fork	Haywood
Wolf Branch	Big Laurel Creek	Madison
Wolf Cove Branch	Beaverdam Creek	Buncombe
Wolf Creek	Bent Creek	Buncombe
Wolf Laurel Branch	Jonathans Creek	Haywood
Wolfpen Creek	Clear Creek	Henderson
Woodruff Branch	W. Fork French Broad River	Transylvania
Woodson Branch	Big Laurel Creek	Madison
Woody Branch	Boylston Creek	Henderson
Wooleyshot Branch	Spring Creek	Madison
Worley Cove Branch	Sandymush Creek	Madison
Wright Branch	Jonathans Creek	Haywood
Wycle Creek	Jonathans Creek	Haywood

"Descriptions and Chemical Character of Public Water Supplies in North Carolina, U. S. Geological Survey, Raleigh, 1947", prepared in cooperation with the State Board of Health, contains the following information regarding public surface-water supplies in the French Broad River Basin. Ownership is municipal unless otherwise indicated.

Asheville, Buncombe County

Population - 1940: 51,310 (1950: 53,000)
Supplies also about 12,000 people in the Buncombe County Water System
Sources - North Fork (67 percent) and Beetree Creek (33 percent)
Treatment - Chlorine, ammonia
Sample collected - May 1, 1944

Color -	3	Bicarbonate -	4.0
Silica -	5.0	Sulfate -	1.7
Iron -	.02	Chloride -	1.1
Calcium -	0.8	Fluoride -	.0
Magnesium -	0.5	Nitrate -	0.1
Na plus K	1.2	Dissolved solids -	14
		Total hardness -	4

Black Mountain, Buncombe County

Population - 1940: 1,042 (1950: 1,174)
Source - Black Mountain Reservoir impounding mountain streams
Treatment - Chlorine, ammonia
Sample collected March 2, 1945

		Bicarbonate -	12
Color -	7	Sulfate -	2.0
Silica -	7.9	Chloride -	0.6
Iron -	0.02	Fluoride -	0.0
Calcium -	1.8	Nitrate -	0.1
Magnesium -	0.6	Dissolved solids -	23
Na plus K -	2.7	Total hardness -	7

Brevard, Transylvania County

Population - 1940: 3,061 (1950: 3,908)
Supplies also about 750 people outside of city limits
Source - Kings Creek
Treatment - Chlorine
Sample collected - August 12, 1946

		Na plus K -	1.7
Color -	7	Bicarbonate -	6.0
pH -	7.6	Sulfate -	0.9
Silica -	5.8	Chloride -	1.0
Iron -	0.01	Fluoride	0.1
Manganese -	0.0	Nitrate -	0.0
Calcium -	0.7	Dissolved solids	16
Magnesium -	0.5	Total hardness -	4

Burnsville, Yancey County

Population - - 1940: 997 (1950: 1,341)
Supplies also about 50 people outside of city limits.
Source - Bolens Creek
Treatment - Rapid sand filtration, chlorine

Burnsville (continued)

Sample collected -	August 7, 1946		
Color -	11	Na plus K -	0.7
pH -	7.5	Bicarbonate -	4.0
Silica -	6.5	Sulfate -	1.2
Iron -	0.01	Fluoride -	0.1
Manganese -	0.0	Nitrate -	0.4
Calcium -	1.4	Dissolved solids -	26
Magnesium -	0.9	Total hardness -	7

Canton, Haywood County

Population - 1940: 4,037 (1950: 4,906)
Supplies also about 150 people outside of city limits
Source - Rough Creek
Treatment - Pressure filtration, chlorine, ammonia
Sample collected - March 18, 1956

Color -	11	Na plus K -	2.6
pH -	7.8	Bicarbonate -	13
Silica -	10	Sulfate -	1.4
Iron -	0.04	Chloride -	1.8
Manganese -	0.0	Fluoride -	0.0
Calcium -	2.4	Nitrate -	0.9
Magnesium	0.9	Dissolved solids -	30
		Total hardness -	10

Clyde, Haywood County

Population - 1940: 516 (1950: 598)
Source - Conners Creek impounded
Treatment - Coagulation with alum, chlorine, rapid sand filtration, final adjustment of pH with soda ash
Sample collected - June 22, 1946

Color -	5	Bicarbonate -	44
pH -	7.0	Sulfate -	10
Silica -	17	Chloride -	1.5
Iron -	0.05	Fluoride -	0.1
Manganese -	0.0	Nitrate -	1.0
Calcium -	4.6	Dissolved solids -	72
Magnesium -	2.0	Total hardness -	20
Na plus K -	14		

Hendersonville, Henderson County

Population - 1940: 5,381 (1950: 6,103)
Supplies also about 3,500 people immediately beyond city limits, East Flat Rock (about 1,000), and Balfour (about 700)
Sources - North Fork Mills River (50 percent) and Bradley Creek (50 percent)
Treatment - Chlorine

Sample collected -	August 28, 1946	Na plus K -	1.9
Color -	17	Bicarbonate -	8.0
pH -	7.0	Sulfate -	1.0
Silica	6.7	Chloride -	1.0
Iron -	0.02	Fluoride -	0.2
Manganese -	0.0	Nitrate -	0.1
Calcium -	1.6	Dissolved solids -	18
Magnesium	0.6	Total hardness -	5

Marshall, Madison County

Population - 1940: 1,160 (1950: 983)
Source - Hunter Creek
Treatment - Chlorine
Sample collected - September 10, 1946

Color -	8	Bicarbonate -	23
pH -	7.2	Sulfate -	2.3
Silica -	10	Chloride -	2.1
Iron -	0.02	Fluoride -	0.1
Manganese -	0.0	Nitrate -	0.0
Calcium -	3.7	Dissolved solids -	44
Magnesium -	1.2	Total hardness -	14
Na plus K -	4.7		

Montreat Reservation, Buncombe County

Population - 1940: about 5,000 (1950: not available)
Source - Piney Creek impounded
Treatment - Chlorine
Sample collected - August 26, 1946

Color -	13	Bicarbonate -	10
pH -	7.0	Sulfate -	1.7
Silica -	8.1	Chloride -	1.8
Iron -	0.27	Fluoride -	0.1
Manganese -	0.0	Nitrate -	0.1
Calcium -	1.5	Dissolved solids -	23
Magnesium -	0.7	Total hardness -	7
Na plus K -	2.9		

Ridgecrest, Buncombe County

Population - 1940: about 260 (1950: not available)
Source - Piney Creek impounded
Treatment - Chlorine
Sample collected - August 26, 1946

Color -	13	Bicarbonate -	10
pH -	7.0	Sulfate -	1.7
Silica -	8.1	Chloride -	1.8
Iron -	0.27	Fluoride -	0.1
Manganese -	0.0	Nitrate -	0.1
Calcium -	1.5	Dissolved solids -	23
Magnesium -	0.7	Total hardness -	7
Na plus K -	2.9		

Spruce Pine, Mitchell County

Population - 1940: 1,968 (1950: 2,280)

	Plant A	Plant B.
Source -	Beaver Creek	Crystal Falls Lake
Treatment -	Chlorine	Chlorine
Sample collected -	1-22-47	2-3-47
Color-	14	5
pH -	6.95	7.1
Silica -	6.9	8.1
Iron -	0.06	0.05
Manganese -	0.0	0.0

Spruce Pine (continued)

	Plant A	Plant B
Calcium -	1.8	1.4
Magnesium -	1.0	0.9
Na plus K -	0.6	2.5
Bicarbonate -	7.0	9.0
Sulfate -	2.2	2.3
Chloride -	0.8	2.0
Fluoride -	0.1	0.0
Nitrate -	0.6	0.0
Dissolved solids -	19	21
Total hardness -	9	7

Waynesville, Haywood County

Population - 1940: 2,940 (1950: 5,295)
Supplies also about 150 people immediately beyond city limits, Hazelwood (about 1,800), and Lake Junaluska Methodist Assembly (about 1,800)
Sources - Cherry Cove Creek and Shiney Creek (75 percent) and Rocky Branch (25 percent)
Treatment - Chlorine
Sample collected - October 4, 1956

Color -	8	Bicarbonate -	7.0
pH -	7.3	Sulfate -	1.2
Silica -	6.5	Chloride -	1.2
Manganese -	0.0	Fluoride -	0.1
Calcium -	1.1	Nitrate -	0.3
Magnesium -	0.6	Dissolved solids -	18
Na plus K -	1.8	Total hardness -	5

Weaverville, Buncombe County

Population - 1940: 880 (1950: 1,111)
Supplies also about 150 people outside of city limits
Sources - Wagner Branch (50 percent) and Ox Creek (50 percent).
Treatment - Chlorine
Sample collected - July 20, 1946

Color -	8	Bicarbonate -	15
pH -	7.3	Sulfate -	3.0
Silica -	16	Chloride	1.5
Iron -	0.04	Fluoride -	0.1
Manganese-	0.0	Nitrate -	0.1
Calcium -	2.0	Dissolved solids -	37
Magnesium -	1.3	Total hardness	10
Na plus K -	3.4		

The following material is taken from "Progress Report No. 2, Public Ground-Water Supplies in North Carolina, U. S. Geological Survey, Raleigh, 1949", prepared in cooperation with the State Board of Health. Ownership is municipal unless otherwise indicated.

Bakersville, Mitchell County

Population - 1940: 437 (1950: 428)
Ownership - Margaret McBee Estate
Source - Springs

Bakersville (continued)

Sample collected - Jan. 31, 1947
Treatment - none

Color-	7	Bicarbonate -	17
pH -	6.3	Sulfate -	1.5
Silica -	11	Chloride -	0.8
Iron -	0.13	Fluoride -	0.1
Manganese -	0.00	Nitrate -	0.4
Calcium -	2.3	Dissolved solids -	29
Na plus K -	3.7	Total hardness -	9

Hot Springs, Madison County

Population - 1940: 773 (1950: 721)
Source - Cascade Spring
Sample collected - Dec. 3, 1946, treated water
Treatment - Chlorination

Color -	12	Bicarbonate -	11
pH -	6.7	Sulfate -	2.5
Silica -	13	Chloride -	1.0
Iron -	0.01	Fluoride -	0.2
Manganese -	0.00	Nitrate -	0.1
Calcium -	1.2	Dissolved solids -	28
Magnesium -	0.5	Total hardness -	5
Na plus K -	4.0		

Newland, Avery County

Population - 1940: 475 (1950: 425)

Sources -	Well 1	Well 2
Depth of well (ft.) -	156	450
Diam. of well (in.) -	6	6
Yield (g.p.m.) -	60	100
Samples collected -	Feb. 13, 1948	Feb. 13, 1948
Treatment -	none	none
Color -	5	4
pH -	6.5	6.3
Silica -	16	14
Iron -	0.04	0.27
Manganese -	0.00	0.00
Calcium -	2.8	2.3
Magnesium -	1.0	0.7
Na plus K -	5.7	5.8
Bicarbonate -	18	20
Sulfate -	0.6	0.8
Chloride -	1.1	1.2
Fluoride -	0.1	0.1
Nitrate -	7.8	2.5
Dissolved solids -	43	38
Total hardness -	11	9

"French Broad River Basin Pollution Survey Report", published in 1957 by the State Stream Sanitation Committee, North Carolina State Board of Health, contains the following information regarding public water supplies in the French Broad River Basin, in addition to that indicated hereinbefore under "Descriptions and Chemical Character of Public Water Supplies in North Carolina".

Asheville, Buncombe County

Estimated population served	85,000
Average m.g.d. used	10
Date installed	1923
Design capacity, m.g.d.	14

Bakerville, Mitchell County

Estimated population served	165
Source of supply	Well
Date installed	1954
Treatment	None

Black Mountain, Buncombe County

Estimated population served	2000
Average m.g.d. used	0.25
Date installed	1912
Design capacity, m.g.d.	0.54

Brevard, Transylvania County

Estimated population served	5,600
Average m.g.d. used	1.0

Source of supply - King and Norton Creeks
Treatment - Coagulation, sedimentation, filtration

Burnsville, Yancey County

Estimated population served	2,000
Average m.g.d. used	0.4
Date installed	1928
Design capacity, m.g.d.	0.5

Canton, Haywood County

Estimated population served	5,000
Average m.g.d. used	0.75
Date installed	1936
Design capacity, m.g.d.	2.7

Clyde, Haywood County

Estimated population served	180
Average m.g.d. used	0.04
Date installed	1925
Design capacity, m.g.d.	0.144

Hendersonville, Henderson County

Estimated population served	16,000
Average m.g.d. used	1.9
Date installed	1923
Design capacity, m.g.d.	4.0

Hot Springs, Madison County

Population served	750
Average m.g.d. used	0.05
Source of supply	Cascade Branch
Date installed	1940
Design capacity, m.g.d.	0.5

Mars Hill, Madison County

Population	1940: 517 (1950: 1,404)
Estimated population served	2,500
Average m.g.d. used	0.25
Source of supply	North Fork Laurel Creek
Date installed	1927
Treatment	Chlorination

Marshall, Madison County

Estimated population served	600
Average m.g.d. served	0.06
Date installed	1920

Montreat, Buncombe County

Estimated population served	5,260
Average m.g.d. used	- -
Date installed	- -
Design capacity, m.g.d.	- -
Source of supply	Slaty Branch

Newland, Avery County

Estimated population served	450
Average m.g.d. used	0.06
Date installed	1947
Design capacity, m.g.d.	0.2

Ridgecrest, Buncombe County

Estimated population served	1,900
Average m.g.d. used	- -
Date installed	- -
Design capacity, m.g.d.	- -
Source of supply	Rattlesnake Branch

Spruce Pine, Mitchell County

Estimated population served	3,000
Average m.g.d. used	0.5
Date installed	1924
Design capacity, m.g.d.	1.35

Waynesville, Haywood County

Estimated population served, including Hazelwood and Lake Junaluska	10,000
Average m.g.d. used	1.2
Date installed	1913
Source of supply	Allens Creek

Weaverville, Buncombe County

Estimated population served	1,800
Average m.g.d. used	0.09
Date installed	1913
Design capacity, m.g.d.	0.1
Source of supply	Ox Creek and Eller Cove

Woodfin Sanitary District, Buncombe County

Estimated population served	8,000
Average m.g.d. used	0.5
Source of supply	Laurel Fork Reems Creek
Date installed	1928
Design capacity, m.g.d.	1.0
Treatment	Chlorination

Data regarding Agricultural Production - Information regarding farm population, total land in farms, harvested cropland, idle cropland, use of fertilizer, and agricultural products for the counties with or within the French Broad River Basin, according to the 1952 Farm Census of 1951 crops, is shown on the following page. The figures are in acres, unless otherwise indicated.

"French Broad River Basin Pollution Survey Report", published in 1957 by the State Stream Sanitation Committee, North Carolina State Board of Health, contains the following information regarding soils, crops, value of products, and agricultural water uses in the French Broad River Basin.

Basin as a whole - The Soils of the French Broad River Basin are well adapted to the growing of a wide variety of agricultural products. The more important crops grown are tobacco, corn, vegetable or truck crops, small grains, and hay.

Number of farms (1950)	20,451
Acres Harvested (1949)	179,000
Value of Products (1949)	
All Crops	$7,344,000
Livestock	3,457,000
Dairy Products	3,132,000
Poultry Products	1,264,000

Main Stem, French Broad River - Agricultural water uses include both livestock watering and irrigation. The practice of irrigating both pasture land and field crops has increased greatly during the past three years. Information supplied by Farm Agents and Soil Conservation Service Technicians indicates that this practice will continue to increase.

Pigeon River - Agricultural water uses include both livestock watering and irrigation. The use of streams as a source of water is of particular significance due to the importance of the drainage area as a leader in both dairying and livestock grazing. The practice of irrigating both pasture land and field crops has increased tremendously since 1950. Information supplied by Farm Agents and Soil Conservation Service Technicians indicates that this practice will continue to increase.

Nolichucky, North Toe, South Toe, and Cane Rivers - Surface water is the major source of agricultural water supply for farm animals, with many streams of the drainage area being used as a source of water for irrigation of both field crops and pasture lands.

Permits to use Water for Irrigation - The following permits to use surface water in the French Broad River Basin for the purpose of irrigation have been issued by the Director of the Department of Conservation and Development in accorance with the provisions of Section 113-8.1, General Statutes of North Carolina, as amended:

Buncombe County

Permit No.	Name	Address	Source	Amount (c.f.s.)
171	A. W. Nesbitt	Fairview	Ashworth Creek	0.54
595	H. H. Harkins	R#6, Asheville	Cane Creek	0.66

ITEM	Avery County	Buncombe County	Haywood County	Henderson County	Madison County	Mitchell County	Transylvania County	Yancey County	Total
Harvested cropland	14,221	40,339	20,205	33,816	31,275	14,900	9,773	18,815	183,344
Idle Cropland	2,818	14,433	3,295	11,087	10,530	7,680	2,210	5,727	57,780
Pasture	24,273	80,007	79,129	29,351	80,209	23,408	10,969	35,841	363,187
Woods, Home-Sites, etc.	48,844	145,160	79,932	69,836	105,750	47,466	33,768	72,470	603,226
Corn Harvested	1.747	13,002	7,867	11,782	9,224	3,098	5,247	5,554	57,521
Cotton Harvested	- -	- -	- -	- -	- -	- -	- -	- -	- -
Tobacco Harvested	111	1,858	1,372	56	3,668	501	23	1,332	8,921
Peanuts	- -	- -	- -	-	- -	- -	- -	- -	- -
Wheat	47	915	209	554	477	5	34	49	2,290
Oats	564	1,010	853	482	1,544	781	65	1,025	6,324
Other small grains	290	982	210	1,290	312	85	98	201	3,468
Soybeans	10	186	33	297	40	- -	141	2	709
Lespedeza	- -	316	23	397	29	4	- -	9	779
Hay Crops Harvested	352	8,532	1,893	3,438	2,777	544	493	963	18,992
Other Hays Cut	8,163	9,309	6,052	4,285	10,586	8,450	2,266	6,879	55,990
Irish potatoes	884	410	201	1,333	587	542	447	524	4,928
Sweet potatoes	23	50	42	118	71	6	14	8	332
Other vegetables grown	999	907	236	3,856	294	33	447	184	6,956
Other crops harvested	1,226	3,899	1,083	6,092	1,433	863	489	1,580	16,665
Total land in farms	90,156	285,948	182,561	144,090	227,764	93,454	56,720	132,853	1213,546
Total land area	158,080	413,440	347,520	224,480	291,840	140,800	242,560	199,040	2017.760
Comm. fert. used, tons	2,231	5,765	3,445	7,905	5,509	1,864	1,797	3,382	31,898
Sows and gilts, No.	107	405	124	192	147	150	96	108	1,329
Cows and Heifers, No.	3,342	13,064	11,595	5,975	8,843	3,134	1,662	5,185	52,800
Hens and Pullets, No.	22,677	114,197	65,714	115,474	66,532	23,720	19,279	40,232	467,824
Tractors in usable condition, No.	37	431	234	805	133	10	98	42	1,790
Farm population, No.	7,745	25,317	12,667	11,974	14,339	8,728	4,665	11,043	96,478
Total population, 1950, No.	13,352	124,403	37,631	30.921	20,522	15,143	15,194	16,306	273,472

Permit No.	(Buncombe continued) Name	Address	Source	Amount (c.f.s.)
43	F. J. Johnson	R#1, Candler	South Hominy Creek	0.19
308	Leslie Davis	R#1, Candler	Moore Creek	0.57
278	E. C. Phipps	Leicester	S. Fk. Turkey Creek	0.24
391	Dr. M. E. Wells	R#2, Leicester	N. Fk. Turkey Creek	0.50
447	H. W. Sams	Weaverville	Elkins Branch	0.54
339	R. & S. Marshbank	R#2, Weaverville	Br. of Big Ivy Creek & Hobbson Branch	0.42
228	J. C. Jarvis	R#1, Marsh Hill	Big Ivy Creek	0.56
181	Frank Brank	R#1, Weaverville	Reems Creek	0.17
390	J. V. Burleson	Barnardsville	N. Fk. Big Ivy Creek	0.56
124	J. H. Stradley	R#1, Asheville	Rice Branch	0.25
314	F. B. Mann	Alexander	Br. of Haw Creek	0.09
235	M. C. McKennon	R#1, Fletcher	Br. of Crane Creek	0.49
45	H. K. Snively	Box 100, Arden	Penner Creek	0.30
293	A. G. Carver, Jr.	R#1, Fletcher	Limestone Creek	1.43
210	E. Warrick	Arden	Ashley Branch	0.30
125	R. F. Reeves	R#1, Arden	Averys Creek	0.25
594	W. M. Hyatt	R#3, Asheville	McKinney Branch	0.20
593	W. M. Hyatt	R#3, Asheville	Cedar Hill Church Branch	0.20
		Haywood County		
239	R. H. Duckett	R#3, Canton	Rhodes Creek	0.14
279	T. J. Reece	R#3, Canton	E. Fk. Pigeon River & Pisgah Creek	0.25
661	Springdale School Inc.	R#3, Canton	Br. of E. Fork, Pigeon R.	0.12
70	S. M. Wines	R#2, Canton	E. Fk. Pigeon River	0.06
280	Dr. A. P. Cline	Box 912, Canton	W. Fk. Pigeon R. & Bird C.	0.54
123	F. A. Gibson	R#2, Canton	Mehaffey Branch	0.08
122	D. L. Farmer	R#2, Canton	Mehaffey Branch	0.10
120	T. E. Shook	R#2, Canton	Mehaffey Branch	0.11
87	E. H. Moore	R#2, Canton	Rhodarmer Cove Branch	0.11
72	M. E. Bumgarner	R#3, Canton	Br. of W. Fk. Pigeon R.	1.05
590	R. H. Boone	R#3, Waynesville	Br. of Raccoon Cr.	0.80
61	P. A. Broyles	R#1, Canton	Br. of Dutch Creek	0.11
341	R. M. Scott	R#3, Canton	Beaverdam Creek	0.01
668	C. B. Hawkins	Clyde	E. Fk. James Branch	0.02
659	O. L. Yates	R#4, Waynesville	Yates Branch	0.03
647	Joe Davis	R#4, Waynesville	White Oak Branch	0.10
634	J. M. King, Jr.	Box 134, Waynesville	Richland Creek	0.04
		Henderson County		
426	G. W. Brown	Horse Shoe	S. Fk. Mills River	0.46
648	Mt. Veg. & Fruit Co.	R#1, Fletcher	Br. of Mills River	0.11
44	C. F. Johnson	Fairview Dairy Farm Hendersonville	Cane Cr.	2.10
236	G. E. Bryant	R#1, Fletcher	French Broad River	2.89
220	Lee Pryor	R#2, Hendersonville	Clear & Kiles Crs.	1.62
579	L. L. Burgin, Jr.	Horse Shoe	Boylston Cr.	0.93
237	Shoal Falls Farm, Inc.	Box 37, Hendersonv.	Show Falls Creek	0.29
		Madison County		
286	Herbert Wild	Walnut	Gentry Branch	0.56
259	J. C. Wild	R#3, Marshall	N. Fk. Big Pine Creek	0.41

Permit No.	(Madison continued) Name	Address	Source	Amount (c.f.s.)
258	J. C. Wild	R#3, Marshall	Brush Creek	0.41
284	Roy McDevitt	R#3, Marshall	Brush Creek	0.51
73	W. W. Ray	R#2, Marshall	Br. of White Oak Branch	0.87
251	L. B. Buckner	R#1, Mars Hill	Gabriel Creek	1.11
604	H. S. Marshbanks	R#2, Weaverville	Big Ivy River	0.61
213	B. W. Metcalf	R#1, Mars Hill	California Creek	0.27
		Yancey County		
287	C. D. Anglin	Box 405, Burnsville	Evans Branch	0.22

No permits have been issued in Avery, Mitchell, and Transylvania Counties.

Records of wells used to supply water to industries - "Bulletin No. 47, Progress Report on Ground Water in North Carolina by M. J. Mundorff, 1945", prepared in cooperation with the Geological Survey, U. S. Department of the Interior and published by the North Carolina Department of Conservation and Development, contains information regarding wells in the French Broad River Basin, used for the purpose of supplying water to industries, as follows:

Buncombe County

Enka
American Enka Corporation
Depth: 10 feet, dismeter: 10 inches, topographic location: valley, chief aquifer: Carolina gneiss, yield: 300 g.p.m. from 2 wells used for cooling, about 850 feet apart.

Haywood County

Canton
Champion Paper and Fibre Company
E. B. Plant
Depth: 168 to 200 feet, diameter: 6 inches, topographic location: valley, chief aquifer: Carolina gneiss, average yield from 4 wells: 65 g.p.m.
Sulfur Storage Plant
Depth: 86 feet, diameter: 6 inches, topographic location: valley, chief aquifer: Carolina gneiss, yield: ?
Sulphur Storage Plant
Depth: 202 feet, diameter: 6 inches, topographic location: valley, chief aquifer: Carolina gneiss, yield: 90 m.g.d.
South of Book Mill
Depth: 146 to 152 feet, diameter: 6 inches, topographic location: valley, chief aquifer: Carolina gneiss, yield from 3 wells: ?

Hazelwood
Hazelwood Tannery
Depth: 60 feet ?, diameter: 6 inches, topographic location: valley, yield: 30 g.p.m. Well was originally 360 feet deep and supplied the Town of Hazelwood which is now supplied by the Town of Waynesville with water from Allens Creek.

Henderson County

Hendersonville, 7 miles north of
Biltmore Hosiery Company
Depth: 100 feet, diameter: 6 inches, topographic location: valley, chief aquifer: Henderson (?) granite, yield: 25 g.p.m.

Industrial Surface Water Supplies - The following information is taken from "French Broad River Basin Pollution Survey Report, State Stream Sanitation Committee, North Carolina State Board of Health, 1957":

American Enka Corporation

Average m.g.d. used	18
Source of supply	Hominy Creek
Treatment	Coagulation, sedimentation, filtration

Beacon Manufacturing Company	
Average m.g.d. used	1.0
Source of supply	Eskridge Cove
Treatment	Coagulation, sedimentation, filtration
Champion Paper and Fibre Company	
Average m.g.d. used	40
Source of supply	Pigeon River
Treatment	Coagulation, sedimentation
Cranston Printworks	
Estimated population served	400
Average m.g.d. used	2.5
Source of supply	Cane Creek
Treatment	Prechlorination, filtration, post-chlorination
Dayton Rubber Company	
Average m.g.d. used	4.3
Source of supply	Allen Creek
Treatment	- -
Ecusta Paper Company	
Estimated population served	2,235
Average m.g.d. used	15
Source of supply	Davidson River
Treatment	Coagulation, sedimentation, filtration, chlorination
A. C. Lawrence Leather Company	
Average m.g.d. used	0.2
Source of supply	Allens Creek
Treatment	- -
Sayles Biltmore Bleachery	
Average m.g.d. used	5.0
Source of supply	Swannanoa River
Treatment	Coagulation, sedimentation, filtration, chlorination
Toxaway Tanning Company	
Average m.g.d. used	0.08
Source of supply	French Broad River
Treatment	- -
Transylvania Tanning Company	
Average m.g.d. used	0.25
Source of supply	Tucker Creek

CHAPTER V - - USE OF WATER FOR RECREATION AND ELECTRIC POWER

"French Broad River Basin Pollution Survey Report, State Stream Sanitation Committee, North Carolina State Board of Health, 1957", contains the following information:

Recreation in the basin as a whole - The recreational assets have been rather widely developed. The basin is internationally famous as a center of tourist activity. Its scenic nature and numerous camps, as well as the public recreational areas maintained by the State and Federal Governments, attract many visitors. Public recreation areas are:

Bent Creek - Picnicking and camping
Powhatan - Picnicking, camping, hiking
North Mills River - Picnicking, camping, individual camp and trailer lots
Big Ivy - Picknicking, camping
Pink Beds - Picnicking
Davidson River - Picnicking, swimming
Roan Mountain - Picnicking
Silver Mine - Picnicking, camping, swimming
Carolina Hemlock - Swimming, picnicking, camping, trailer space, hiking
Mt. Mitchell State Park - Picnic area, camp grounds, recreation lodge.

The largest concentration of summer camps in the State is to be found in the basin. Approximately 50 camps for boys and girls are located therein, offering a variety of recreational activities. The existence and maintenance of water of suitable quality for recreation is of unusual significance in these areas.

Fishing is extensive throughout the basin. It is reported that trout, bass, pike, bream, catfish, crappie, and white bass are found in the waters thereof. Some of the best trout fishing in the State is to be found in the clean mountain streams. The North Carolina Wildlife Resources Commission annually stocks many of the streams of the area with trout, and works with the U. S. Forestry Service in the management of additional trout streams in the Cooperative Wildlife Management Areas.

Game of a wide variety are present, and hunting is prevalent throughout the basin. During the hunting season, hunters have their choice of several Cooperative Wildlife Management Areas in which to hunt. Deer, bear, grouse, squirrel, coon, boar, turkey, rabbits, quail, and pheasants can be found in the area. Organized hunts on Cooperative Management Areas are held under the joint supervision of State and Federal authorities.

Recreation in the basin of the main stem of the French Broad River - - Recreational facilities provide for swimming, fishing, camping, and picnicking. There are many privately owned camps providing recreational facilities for scores of boys and girls. Picnic areas, principally in Pisgah National Forest, are used constantly during the tourist season. The scenic nature of the basin lures many people to the numerous trails therein.

Fishing is prevalent in the smaller unpolluted tributaries as well as the headwaters of the French Broad River. The North Carolina Wildlife Resources Commission annually stocks many of the streams in the basin with trout. Bass, bream, and crappie are common to the basin's waters.

Recreation in the Pigeon River Basin - Facilities include provisions for fishing, camping, and picnicking. There are many camps providing recreational

activities for scores of boys and girls. Twenty-three per cent of the basin is in the Great Smoky National Park which annually attracts thousands of tourists. Picnic areas in both the Great Smoky Mountain National Park and the National Forest are in constant demand. The scenic beauty of the entire basin lures many people to the numerous trails.

Fishing is prevalent in many of the smaller unpolluted streams of the basin as well as the headwaters of the Pigeon River. The North Carolina Wildlife Resources Commission annually stocks many of the streams with trout, and bass and bream are prevalent.

Recreation in the Nolichucky River Basin - The scenic beauty attracts many tourists. The Blue Ridge Parkway, one of the most scenic highways in the State, has made the basin more accessible. The lofty peaks of Mt. Mitchell and the Mt. Mitchell State Park comprise probably the greatest single attraction.

Fishing is prevalent in the unpolluted streams. In order to improve fishing, the North Carolina Wildlife Resources Commission annually stocks many streams with trout. Bass and bream are prevalent.

Electric Power in the Basin of the Main Stem of the French Broad River - The basin contains four electric-power projects. Carolina Power and Light Company operates a hydroelectric plant and a steam plant on the French Broad River. The Rural Electrification Authority also operates a hydroelectric plant on the French Broad River. The Cascade Power Company operates a hydroelectric plant on Little River. The total power output of the four plants is estimated to be 19,200 kilowatts.

Electric Power in the Pigeon River Basin - There are two electric-power porjects on the Pigeon River. Champion Paper & Fibre Company operates steam-driven turbines that generate 50,000 kilowatts per hour, and Carolina Power and Light Company operates a 135,000 horse-power hydroelectric plant.

Electric Power in the Nolichucky River Basin - French Broad Electric Company operates the only electric-power project in the basin. This plant, located on Cane River, generates 475 kilowatts of electric power.

Stream Flow Records - - Mean monthly, maximum daily, minimum daily, and mean weekly discharges, all in million gallons per day, at 30 gaging stations in the French Broad River Basin, may be found in "Hydrologic Data on the French Broad River Basin, 1857-1945", published in 1950 by the North Carolina Department of Conservation and Development and prepared in cooperation with the United States Geological Survey. Stream-flow data for years subsequent to 1945, at these gaging stations, are shown below. The monthly discharges are yearly means.

Allen Creek near Hazelwood, Haywood County

Location - - Stevens continuous recorder, 180 feet downstream from Rocky Branch and town of Waynesville watershed boundary, 3.0 miles upstream from mouth, and 3.3 miles south of Hazelwood.

Drainage area - - 14.4 square miles

Records available - - August 19, 1949 to date

	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	203	181	177	251
Maximum monthly discharge (c.f.s.)	315	280	274	389
Mean monthly discharge (m.g.d.)	25.6	20.2	21.8	18.6
Mean monthly discharge (c.f.s.)	39.6	31.3	33.7	28.8
Minimum monthly discharge (m.g.d.)	6.4	6.5	4.39	3.49
Minimum monthly discharge (c.f.s.)	9.9	10.0	6.8	5.4

Beetree Creek near Swannanoa, Buncombe County

Location (revised) - - Water-stage recorder and modified 4-foot Parshall flume set in masonry control, 200 feet upstream from upper intake to Asheville water supply, 1000 feet upstream from Beetree Reservoir, and 3.8 miles north of Swannanoa.

Drainage area - - 5.46 square miles.

Records available - - February 1926 to date.

February 1926 to December 1945

Average discharge - - 6.7 m.g.d.
Extremes - - Maximum discharge, 885 m.g.d. Aug. 13, 1940 (gage height - 6.20 feet), by computation of flow over weir; minimum 0.43 m.g.d. July 22, 1926 and Aug. 6, 1930; minimum gage height, 0.31 foot, Sept. 18, 1944.

Remarks - - Records good except those above 26 m.g.d., which are fair.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	78	96	62	138	66	31	88	125
Maximum monthly discharge (c.f.s.)	120	148	96	213	102	48	136	193
Mean monthly discharge, (m.g.d.)	7.69	6.23	6.65	11.6	7.43	5.06	4.70	5.21

Extreme minimum discharge - 4.39 m.g.d. Dec. 17 and 18, 1943, result of of low temperature (gage height - 0.52 feet)

Remarks - - Records good except those for periods of ice effect, no gage-height record, or shifting-control, which are fair.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	272	271	269	284	309	171	287	231
Maximum monthly discharge (c.f.s.)	421	420	416	440	479	264	445	358
Mean monthly discharge (m.g.d.)	26.5	20.2	25.9	33.9	22.8	18.0	21.3	14.5
Mean monthly discharge (c.f.s.)	41.0	31.2	40.1	52.4	35.3	27.9	32.9	22.4
Minimum monthly discharge (m.g.d.)	9.0	6.2	10	17	11	6.5	6.1	5.1
Minimum daily discharge (c.f.s.)	14	9.6	16	27	17	10	9.5	7.9

Cane Creek at Fletcher, Henderson County

Location - - Water-stage recorder at county highway bridge, 0.5 mile upstream from Hoopers Creek, 0.5 mile northeast of Fletcher, and 0.8 mile downstream from county line. Datum of gage is 2,072.22 feet above mean sea level.

Drainage area - 63.1 square miles.

Records available - October 1942 to date.

October 1942 to December 1945

Extreme maximum discharge - 1180 m.g.d. Jan. 19, 1942 (gage height - - 7.97 feet), from rating curve extended above 549 m.g.d. by log-arithmic plotting.

Extreme minimum discharge - - 15 m.g.d. Sept. 10 and 11, 1944 (gage height - - 0.43 foot).

Remarks - - Records good except those for periods of ice effect or no gage-height record, which are fair.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	762	611	592	717	749	378	795	652
Maximum monthly discharge (c.f.s.)	1180	946	916	1110	1160	585	1230	1010
Mean monthly discharge (m.g.d.)	62.9	46.6	51.7	82.7	57.6	37.3	44.8	34.4
Mean monthly discharge (c.f.s.)	97.4	72.1	80.1	128	89.2	57.8	69.4	53.2
Minimum monthly discharge (m.g.d.)	19	12	16	39	19	11	14	6.5
Minimum monthly discharge (c.f.s.)	29	19	25	60	30	17	21	10

Cane River near Sioux, Yancey County

Location - - Water-stage recorder on State Highway 26, 1¼ miles east of Sioux and 1.4 miles upstream from confluence with North Toe River. Datum of gage is 2045.34 feet above mean sea level.

	1946	1947	1948	1949	1950	1951	1952	1953
Mean monthly discharge (c.f.s.)	11.9	9.64	10.3	17.9	11.5	7.83	7.28	8.06
Minimum monthly discharge (m.g.d.)	0.71	0.58	0.97	2.45	1.42	0.58	0.39	0.39
Minimum monthly discharge (c.f.s.)	1.1	0.9	1.5	3.8	2.2	0.9	0.6	0.6

Big Laurel Creek near Stackhouse, Madison County

Location (revised) - - Water-stage recorder, 0.2 mile downstream from Big Hurricane Creek, 0.6 mile upstream from Little Hurricane Creek, 50 feet west of State Highway 208, 3 miles north of Stackhouse, and 4 miles upstream from mouth. Datum of gage is 1,595.68 feet above mean sea level, datum of 1929, supplementary adjustment of 1936.

Drainage area - - 126 square miles

Records available - - May 1934 to date

May 1934 to December 1945

Average discharge - - 114 m.g.d.
Extreme maximum discharge - - 4,690 m.g.d. Mar. 25, 1935 (gage height - 7.94 ft.)
Extreme minimum discharge - - 7.1 m.g.d. Jan. 6, 1942, result of low temperature (gage height - 0.92 ft.)
Extreme minimum daily discharge - - 14 m.g.d. Oct. 9, 1941.

Remarks - - Records good except those for periods of ice effect, which are fair.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	2090	1470	1110	1300	1340	814	833	1270
Maximum monthly discharge (c.f.s.)	3230	2280	1720	2020	2070	1260	1290	1960
Mean monthly discharge (m.g.d.)	123	108	120	145	145	125	83.3	85.3
Mean monthly discharge (c.f.s.)	190	167	185	224	225	193	129	132
Minimum monthly discharge (m.g.d.)	25	27	23	45	30	26	15	12
Minimum monthly discharge (c.f.s.)	38	42	35	70	46	40	23	19

Boylston Creek near Horseshoe, Henderson County

Location - Water-stage recorder, 100 feet upstream from county highway bridge, 1.7 miles upstream from mouth, and 2 miles north of Horseshoe. Datum of gage is 2,069,39 feet above mean sea level.

Drainage area - - 14.8 square miles

Records available - - December 1942 to date

December 1942 to December 1945

Extreme maximum discharge - 245 m.g.d. Dec. 29, 1942 (gage height - 3.50 feet)

Drainage area - 157 square miles.

Records available - May 1934 to date.

May 1934 to December 1945

Extreme maximum discharge - - 17,600 m.g.d. Aug. 13, 1940 (gage height - 17.8 feet), by slope area method.
Extreme minimum discharge - 12 m.g.d. Jan. 6, 1940 (gage height - 1.14 feet), result of low temperature.
Extreme minimum discharge - 18 m.g.d. Oct. 7, 1941.

Remarks - Considerable diurnal fluctuation and some regulation caused by small mills and a power plant above station.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	2470	2350	1200	3440	1710	1380	1050	2280
Maximum monthly discharge (c.f.s.)	3830	3640	1850	5330	2640	2130	1630	3530
Mean monthly discharge (m.g.d.)	186	163	151	228	186	138	116	112
Mean monthly discharge (c.f.s.)	288	253	234	353	288	214	179	174
Minimum monthly discharge (m.g.d.)	32	30	27	79	47	26	18	17
Minimum monthly discharge (c.f.s.)	50	47	42	122	72	41	28	27

Cataloochee Creek near Cataloochee, Haywood County

Location - - Water-stage recorder and concrete control at bridge on State Highway 284, 500 feet upstream from Little Cataloochee Creek and 2 miles north of Cataloochee. Datum of gage is 2,457.48 feet above mean sea level.

Drainage area - 49.2 square miles.

Records available - May 1934 to date.

May 1934 to December 1945

Average discharge - 64.7 m.g.d.
Extreme maximum discharge - 2,190 m.g.d. Aug. 30, 1940 (gage height - 7.01 feet), from rating curve extended above 969 m.g.d.
Extreme minimum discharge - 5.8 m.g.d. Jan. 2, 1940, Dec. 17, 1943, and Dec. 24, 1943 (gage height - 1.87 feet), result of low temperature.

Remarks - Records excellent except those for periods of ice effect, which are fair.

	1946	1947	1948	1949	1950	1951	1952
Maximum monthly discharge (m.g.d.)	1030	1310	614	460	840	769	
Maximum monthly discharge (c.f.s.)	1600	2030	950	712	1300	1190	
Mean monthly discharge (m.g.d.)	82.7	65.9	67.8	93.7	76.2	69.1	

	1946	1947	1948	1949	1950	1951	1952
Mean monthly discharge (c.f.s.)	128	102	105	145	118	107	
Minimum monthly discharge (m.g.d.)	17	16	16	32	19	17	
Minimum monthly discharge (c.f.s.)	27	25	24	49	30	27	
Maximum mean weekly discharge (m.g.d.)	405	574	357	256	320	308	288
Maximum mean weekly discharge (c.f.s.)	627	888	553	365	495	477	446
Minimum mean weekly discharge (m.g.d.)	18	17	16	36	21	18	15
Minimum mean weekly discharge (c.f.s.)	28	26	25	56	33	28	23

Catheys Creek near Brevard, Transylvania County

Location - Stephens Type E weekly recorder, 150 feet upstream from U.S. Highway 64, 1.1 miles downstream from Kuyendall Creek, 1.2 miles upstream from mouth, and 3.5 miles southwest of Brevard.

Drainage area - 12.1 square miles.

Records available - Oct. 21, 1944 to date.

	1945	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	73	130	164	208	236	176	109	258	250
Maximum monthly discharge (c.f.s.)	113	202	254	322	366	273	169	400	387
Mean monthly discharge (m.g.d.)	18.1	26.7	20.0	28.4	37.3	26.2	20.2	23.4	20.4
Mean monthly discharge (c.f.s.)	28.0	41.3	31.0	43.9	57.7	40.5	31.2	36.2	31.6
Minimum monthly discharge (m.g.d.)	7.1	7.8	7.1	11	19	12	7.8	6.5	6.5
Minimum daily discharge (c.f.s.)	11	12	11	17	30	19	12	10	10
Maximum mean weekly discharge (m.g.d.)	34	79	63	80	101	67	48	105	95
Minimum mean weekly discharge (m.g.d.)	7.8	8.4	7.1	12	20	14	8.4	6.5	6.5
Maximum mean weekly discharge (c.f.s.)	53	123	97	124	156	103	75	163	147
Minimum mean weekly discharge (c.f.s.)	12	13	11	18	31	21	13	10	10

Clear Creek near Hendersonville, Henderson County

Location - Continuous recorder at county highway bridge, 0.6 mile upstream from Allen Branch, 1.0 mile downstream from Wolfpen Creek, 1.2 miles upstream from mouth, and 2.75 miles northeast of Hendersonville.

Drainage area - 42.2 square miles.

Records available - May 31, 1945 to date.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	583	408	417	879	801	420	762	572
Maximum monthly discharge (c.f.s.)	903	631	646	1360	1240	650	1180	885
Mean monthly discharge (m.g.d.)	53.2	40.1	51.2	73.6	60.1	39.1	40.4	30.2
Mean monthly discharge (c.f.s.)	82.3	62.0	79.2	114	93.1	60.6	62.6	46.7
Minimum monthly discharge (m.g.d.)	16	13	19	33	25	12	11	7.8
Minimum monthly discharge (c.f.s.)	25	20	30	51	38	19	17	12
Maximum mean weekly discharge (m.g.d.)	174	168	174	271	239	133	205	168
Minimum mean weekly discharge (m.g.d.)	18	14	23	35	30	14	12	10
Maximum mean weekly discharge (c.f.s.)	270	260	270	419	370	206	318	260
Minimum mean weekly discharge (c.f.s.)	28	21	35	52	46	22	19	16

Crab Creek near Penrose, Transylvania County

Location - Water-stage recorder, 0.4 mile downstream from Henderson County Line, 1.6 miles above mouth (tributary to Little River), and 3 miles southeast of Penrose.

Drainage area - 10.9 square miles.

Records available - October 1, 1942 to date.

	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953
Max. monthly disch. (m.g.d.)	.107	118	74	142	120	162	215	273	117	261	141
Max. monthly disch. (c.f.s.)	165	183	115	220	186	250	333	422	181	404	218
Mean monthly disch. (m.g.d.)	21.3	17.4	15.7	21.9	16.8	21.6	29.1	20.0	14.6	18.0	15.1
Mean monthly disch. (c.f.s.)	33.0	26.9	24.3	33.9	26.0	33.5	45.1	30.9	22.6	27.8	23.3
Min. monthly disch. (m.g.d.)	6.5	5.5	7.1	6.5	5.4	7.8	14	8.4	4.9	6.1	5.1
Min. monthly disch. (c.f.s.)	10	85	11	10	8.3	12	22	13	7.6	9.4	7.9
Max. mean wk. disch. (m.g.d.)	53	64	41	59	52	66	67	70	41	69	54
Min. mean wk. disch. (m.g.d.)	6.5	6.3	7.8	7.1	5.7	8.4	15	9.7	5.2	6.5	5.2
Max. mean wk. disch. (c.f.s.)	82	99	64	89	81	102	103	109	64	107	84
Min. mean wk. disch. (c.f.s.)	10	9.7	12	11	8.9	13	23	15	8.0	10	8.1

Davidson River near Brevard, Transylvania County

Location - Water-stage recorder, 150 feet upstream from State Highway

280, 2.0 miles upstream from mouth, 2.1 miles downstream from Avery Creek, and 3.5 miles northeast of Brevard. Datum of gage is 2,115.13 feet above mean sea level.

Drainage area - 40.4 square miles.

Records available - December 1920 to date.

December 1920 to December 1945

Extreme maximum discharge - 5,400 m.g.d. Aug. 15, 1928 (gage height - 11.8 feet) from rating curve extended above 840 m.g.d.
Extreme minimum discharge - 9.7 m.g.d. Sept. 19-21, 1925 (gage height - 0.34 foot) result of temporary regulation.

Remarks - Records excellent except those for periods of ice effect or gage-height record.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	596	795	711	1460	820	456	891	891
Maximum monthly discharge (c.f.s.)	923	1230	1100	2260	1270	706	1380	1380
Mean monthly discharge (m.g.d.)	87.2	66.5	105	127	87.2	69.8	78.2	64.6
Mean monthly discharge (c.f.s.)	135	103	163	197	135	108	121	100
Minimum monthly discharge (m.g.d.)	23	15	36	54	26	19	19	14
Minimum monthly discharge (c.f.s.)	36	23	55	84	41	30	29	21
Minimum mean weekly discharge (m.g.d.)	25	16	38	57	29	20	20	15
Minimum mean weekly discharge (c.f.s.)	39	25	59	88	45	31	31	23
Maximum mean weekly discharge (m.g.d.)	288	284	315	351	322	201	363	313
Maximum mean weekly discharge (c.f.s.)	444	440	488	544	499	311	562	485

French Broad River at Asheville, Buncombe County

Location - Water-stage recorder at Pearson (formerly called Bingham School) Bridge in Asheville, 2.3 miles downstream from Southern Railway Station and 3.1 miles downstream from Swannanoa River. Datum of gage is 1,950.28 feet above mean sea level.

Drainage area - 945 square miles.

Records available - September 1895 to December 1901, January 1905 to September 1922 (at Smith Bridge, 1.5 miles upstream), and October 1922 to date in reports of the U. S. Geological Survey. September 1895 to December 1901, March 1903 to September 1922 (at Smith Bridge), and October 1922 to December 1923 in North Carolina Department of Conservation and Development Bulletin 34 and Tennessee Division of Geology Bulletin 34. Records, prior to January 1, 1909, have been revised in these two bulletins.

48 years (1895-1901, 1903-1945)

Average discharge - 1,409 m.g.d.
Extreme maximum discharge - 71,100 m.g.d. July 16, 1916 (gage height - 23.1 feet, present site and datum, from floodmarks), from rating curve extended from 27,800 m.g.d.
Extreme minimum discharge - 154 m.g.d. at times in August and September 1925 (gage height - 0.16 foot).

Remarks - Slight diurnal fluctuation and occasional slight regulation at low flow caused by power plants and small reservoirs above station. Small diversions from tributaries for water supply.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	8660	7750	7950	8010	8270	5250	8300	8200
Maximum monthly discharge (c.f.s.)	13400	12000	12300	12400	12800	8120	14400	12700
Mean monthly discharge (m.g.d.)	1448	1090	1437	1989	1390	1016	1209	1026
Mean monthly discharge (c.f.s.)	2241	1687	2224	3079	2152	1572	1872	1589
Minimum monthly discharge (m.g.d.)	410	296	459	898	590	327	349	284
Minimum monthly discharge (c.f.s.)	634	458	710	1390	913	506	540	440
Maximum mean weekly discharge (m.g.d.)	5890	3970	4770	4950	3900	2990	5210	4860
Minimum mean weekly discharge (m.g.d.)	468	327	547	969	685	333	355	322
Maximum mean weekly discharge (c.f.s.)	9120	6140	7390	7670	6040	4630	8070	7520
Minimum mean weekly discharge (c.f.s.)	724	506	847	1500	1060	516	550	499

French Broad River at Bent Creek, Buncombe County

Location - Water-stage recorder, 50 feet downstream from Bent Creek, 6 miles upstream from Hominy Creek, and 7 miles south of Asheville. Datum of gage is 1,995.95 feet above mean sea level.

Drainage area - 676 square miles.

Records available - May 1934 to date.

May 1934 to December 1945

Average discharge - 1,015 m.g.d.
Extreme maximum discharge - 14,200 m.g.d. Aug. 14, 1940 (gage height - 12.6 feet).
Extreme minimum discharge - 229 m.g.d. Oct. 13, 1941 (gage height - 2.2 feet).
Maximum stage known - about 27.3 feet July 15, 1916, from flood marks. Flood of August 1928 reached a stage of about 16.1 feet, from floodmarks.

Remarks - Diurnal fluctuation at low flow caused by power plant above station.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	6780	5460	6460	6050	6980	4550	6910	7110
Maximum monthly discharge (c.f.s.)	10500	8450	10000	9370	10800	7050	10700	11000
Mean monthly discharge (m.g.d.)	1224	922	1230	1661	1155	897	1024	891
Mean monthly discharge (c.f.s.)	1894	1427	1904	2571	1788	1388	1585	1380
Minimum monthly discharge (m.g.d.)	353	231	426	775	484	287	298	251
Minimum monthly discharge (c.f.s.)	546	358	660	1200	750	444	462	389
Maximum mean weekly discharge (m.g.d.)	4880	3130	4010	4020	3370	2620	3390	4060
Maximum mean weekly discharge (c.f.s.)	7550	4840	6200	6220	5210	4060	5250	6290
Minimum mean weekly discharge (c.f.s.)	646	407	764	1310	883	456	466	414

French Broad River at Blantyre, Transylvania County

Location - - Water-stage recorder at highway bridge, 700 feet east of Blantyre Railroad Station and 3.4 miles downstream from Little River. Datum of gage is 2,060.32 feet above mean sea level.

Drainage area - - 296 square miles.

Records available - December 1920 to date.

December 1920 to December 1945

Average discharge - 592 m.g.d.
Extreme maximum discharge - 17,100 m.g.d. Aug. 16, 1928 (gage height - 22.9 feet), from rating curve extended above 7,430 m.g.d.
Extreme minimum discharge - 92 m.g.d. Sept. 21, 1925 (gage height - 1.83 feet).
Maximum stage known - 27.1 feet in July 1916, from floodmarks.

Remarks - Diurnal fluctuation at low flow caused by power plant above Station.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	5190	3440	4160	4740	3980	2830	4340	5250
Maximum monthly discharge (c.f.s.)	8040	5320	6440	7330	6160	4380	6720	8130
Mean monthly discharge (m.g.d.)	717	537	744	986	674	505	587	564
Mean monthly discharge (c.f.s.)	1111	832	1152	1526	1043	782	909	873
Minimum monthly discharge (m.g.d.)	211	132	227	417	273	148	142	142
Minimum monthly discharge (c.f.s.)	327	190	352	645	423	229	220	220
Maximum mean weekly discharge (c.f.s.)	4560	2730	3580	3390	2720	2410	3630	3890

	1946	1947	1948	1949	1950	1951	1952	1953
Minimum mean weekly discharge (c.f.s.)	380	226	422	745	503	247	224	237
Maximum mean weekly discharge (m.g.d.)	2950	1760	2310	2190	1760	1560	2340	2510
Minimum mean weekly discharge (m.g.d.)	245	146	273	481	325	160	145	153

French Broad River at Calvert, Transylvania County

Location (revised) - Water-stage recorder at township bridge 0.8 mile southeast of railroad station at Calvert, and 1.4 miles downstream from East Fork. Datum of gage is 2,154.63 feet above mean sea level.

Drainage area - 103 square miles.

Records available - October 1924 to date.

October 1924 to December 1925

Average discharge - 216 million gallons per day.
Extreme maximum discharge - 10,400 m.g.d. Aug. 15, 1928 (gage height - 13.0 feet), from rating curve extended above 2,330 m.g.d.
Extreme minimum discharge - 35 m.g.d. Sept. 17-23, 1925.
Minimum gage height - 0.26 foot Dec. 17, 1943.
Maximum stage known - 18.3 feet in July 1916, from flood-crest reference mark.

Remarks - Records excellent except those for periods of ice effect or no gage-height record, which are fair.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	1690	1550	1730	2030	1910	1200	2120	2480
Maximum monthly discharge (c.f.s.)	2610	2400	2680	3140	2960	1860	3280	3840
Mean monthly discharge (m.g.d.)	259	191	273	365	256	188	215	218
Mean monthly discharge (c.f.s.)	401	295	422	565	396	291	333	337
Minimum monthly discharge (m.g.d.)	84	59	87	174	122	55	56	62
Minimum monthly discharge (c.f.s.)	130	91	134	270	189	85	86	96
Maximum mean weekly discharge (m.g.d.)	846	612	782	762	652	525	840	937
Minimum mean weekly discharge (m.g.d.)	90	61	101	182	131	58	59	63
Maximum mean weekly discharge (c.f.s.)	1310	948	1210	1180	1010	812	1300	1450
Minimum mean weekly discharge (c.f.s.)	139	94	156	282	229	90	92	98

French Broad River at Hot Springs, Madison County

Location - Water-stage recorder at Hot Springs, 0.3 mile upstream from bridge on U. S. Highways 25 and 70, and 0.7 mile upstream from Spring Creek. Datum of gage is 1,311.55 feet above mean sea level.

Drainage area - 1,567 square miles.

Records available - May 1934 to October 1949.

May 1934 to December 1945

Average discharge - 1,601 million gallons per day.
Extreme maximum discharge - 48,400 m.g.d. Aug. 30, 1940 (gage height - 16.1 feet), by slope-area method.
Extreme minimum discharge - 110 m.g.d., Oct. 6, 1935 and Sept. 28, 1936 (gage height - 2.10 feet).
Extreme minimum daily discharge - 293 m.g.d., Oct. 14 and 15, 1941.
Maximum stage known - 19.3 feet July 16 or 17, 1916, from floodmarks 0.25 mile downstream.

Remarks - Diurnal fluctuation during low flow caused by power plant above station, which was discontinued in October 1949.

	1946	1947	1948
Maximum monthly discharge (m.g.d.)	17,800	13,400	10,300
Maximum monthly discharge (c.f.s.)	27,500	20,800	16,000
Mean monthly discharge (m.g.d.)	1966	1466	1814
Mean monthly discharge, (c.f.s.)	3044	2270	2808
Minimum monthly discharge (m.g.d.)	530	386	545
Minimum monthly discharge (c.f.s.)	820	598	844
Maximum mean weekly discharge (m.g.d.)	8590	6330	5810
Minimum mean weekly discharge (m.g.d.)	576	421	659
Maximum mean weekly discharge (c.f.s.)	13,300	9800	9000
Minimum mean weekly discharge (c.f.s.)	891	652	1020

French Broad River at Marshall, Madison County

Location - Water-stage recorder, 0.4 mile upstream from Hayes Creek, 1 mile southeast of Marshall, and 1.2 miles downstream from Ivy River. Datum of gage is 1,646.79 feet above mean sea level.

Drainage area - 1,332 square miles.

Records available - October 1942 to date.

October 1942 to December 1945

Extreme maximum discharge - 15,200 m.g.d. Dec. 29, 1942 (gage height - 7.59 feet).
Extreme minimum discharge - 386 m.g.d. Sept. 10, 1944 (gage height - 0.92 foot).
Extreme minimum daily discharge - 404 m.g.d. Sept. 10, 1944.

Remarks - Diurnal fluctuations at low flow caused by power plants above station.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	12500	10900	8720	9750	9040	6650	12100	11400
Maximum monthly discharge (c.f.s.)	19300	16800	13500	15100	14000	10300	18800	17600
Mean monthly discharge (m.g.d.)	1756	1289	1649	2304	1641	1216	1400	1185
Mean monthly discharge (c.f.s.)	2718	1990	2552	3556	2541	1883	2167	1834
Minimum monthly discharge (m.g.d.)	497	342	510	1070	646	376	388	297
Minimum monthly discharge (c.f.s.)	770	530	790	1660	1000	582	600	460
Maximum mean weekly discharge (m.g.d.	7110	5140	5370	5140	4280	3470	6200	5910
Minimum mean weekly discharge (m.g.d.)	541	375	637	1120	762	385	402	340
Maximum mean weekly discharge (c.f.s.)	11000	7950	8310	7960	6620	5370	9600	9150
Minimum mean weekly discharge (c.f.s.)	837	581	985	1730	1180	596	622	527

French Broad River at Rosman, Transylvania County

Location (revised) - Water-stage recorder at bridge on U. S. Highway 178 at Rosman, 1.0 mile upstream from East Fork. Datum of gage is 2,173.83 above mean sea level.

Drainage area - 67.9 square miles.

Records available - May 1907 to June 1909, January 1936 to date.

1907-1908, 1936-1945

Average discharge - 148 m.g.d.
Extreme maximum discharge - 6,080 m.g.d. Aug. 30, 1940 (gage height - 11.86 feet), by slope area-method.
Extreme minimum discharge - 15 m.g.d. Jan. 3, 1940 (gage height - 1.51 feet), result of low temperature.
Maximum stage known - 13.9 feet in July 1916, from floodmarks.

Remarks - Records excellent except those for period of shifting control, which are good, and those for periods of ice effect, which are fair.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	1070	1130	1370	1060	1400	769	1400	1650
Maximum monthly discharge (c.f.s.)	1660	1750	2120	1640	2160	1190	2160	2550
Mean monthly discharge (m.g.d.)	168	130	189	228	162	127	133	135
Mean monthly discharge (c.f.s.)	260	201	293	353	250	196	206	209
Minimum monthly discharge (m.g.d.)	55	41	59	111	66	38	36	34
Minimum monthly discharge (c.f.s.)	85	63	91	172	102	59	56	53

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum mean weekly discharge (m.g.d.)	559	445	542	501	435	332	556	598
Minimum mean weekly discharge (m.g.d.)	61	42	66	116	78	40	36	36
Maximum mean weekly discharge (c.f.s.)	865	689	839	775	673	514	860	926
Minimum mean weekly discharge (c.f.s.)	94	65	102	179	120	62	56	56

Hominy Creek at Candler, Buncombe County

Location - Water-stage recorder, 0.1 mile downstream from Pole Creek and 1 mile east of Candler. Datum of gage is 2,065.83 feet above mean sea level.

Drainage area - 80.5 square miles.

Records available - October 1942 to date.

October 1942 to December 1945

Extreme maximum discharge - 982 m.g.d. June 28, 1943 (gage height - 4.51 feet).
Extreme minimum discharge - 9.7 m.g.d. Nov. 8, 1944.
Minimum gage height - 0.83 foot, Nov. 25, 1942, Sept. 28. 1944, and Nov. 8, 1944.

Remarks - Diurnal fluctuation during low flow cuased by small mill above station.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	736	592	645	1390	827	362	579	486
Maximum monthly discharge (c.f.s.)	1140	916	999	2150	1280	561	896	753
Mean monthly discharge (m.g.d.)	73.6	47.0	63.3	95.0	71.7	52.3	58.9	38.6
Mean monthly discharge (c.f.s.)	114	72.8	98.0	147	111	81.0	91.1	59.7
Minimum monthly discharge (m.g.d.)	22	13	21	50	27	18	19	9.0
Minimum monthly discharge (c.f.s.)	34	20	33	77	42	28	29	14
Maximum mean weekly discharge (m.g.d.)	216	199	225	304	228	130	263	183
Minimum mean weekly discharge (m.g.d.)	23	16	24	52	33	19	20	9.7
Maximum mean weekly discharge (c.f.s.)	335	308	349	471	353	202	407	283
Minimum mean weekly discharge (c.f.s.)	36	24	37	80	51	30	31	15

Ivy River near Marshall, Madison County

Location - Water-stage recorder, 0.2 mile downstream from county county bridge, 1.9 miles upstream from mouth, and 4 miles southeast of Marshall. Datum of gage is 1,700.41 feet above mean sea level.

Drainage area - 158 square miles.

Records available - May 1934 to date.

May 1934 to December 1945

Average discharge, 97.1 m.g.d.
Extreme maximum discharge - 5,740 m.g.d. Aug. 30, 1940 (gage height - 12.67 feet), by slope-area method.
Extreme minimum discharge - 1.94 m.g.d. Jan. 20, 1940, result of low temperature.

Remarks - Records good except those for periods of ice effect or no gage-height record, which are fair.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	1980	1760	1140	1120	1310	769	1130	1860
Maximum monthly discharge (c.f.s.)	3070	2730	1770	1740	2030	1190	1750	2880
Mean monthly discharge (m.g.d.)	121	87.9	85.9	134	113	82	69.1	66.5
Mean monthly discharge (c.f.s.)	187	136	133	208	175	127	107	103
Minimum monthly discharge (m.g.d.)	19	17	17	39	25	16	9.0	5.5
Minimum monthly discharge (c.f.s.)	29	26	26	61	38	25	14	8.5
Maximum mean weekly discharge (m.g.d.)	612	612	503	518	479	275	387	536
Minimum mean weekly discharge (m.g.d.)	21	19	18	43	27	17	10	6.5
Maximum mean weekly discharge (c.f.s.)	947	947	778	554	741	425	599	830
Minimum mean weekly discharge (c.f.s.)	32	30	28	67	42	26	16	10

Jonathan Creek near Cove Creek, Haywood County

Location - Water-stage recorder, 500 yards downstream from ford, 0.7 mile upstream from mouth, and 2 miles downstream from Cove Creek and Cove Creek post office. Datum of gage is 2,383.89 feet above sea level, datum of 1929.

Drainage area - 65.3 square miles.

Records available - May 1930 to date.

May 1930 to December 1945

Average discharge - 78.7 m.g.d.
Extreme maximum discharge - 2,070 m.g.d. Aug. 30, 1940 (gage height - 7.51 feet), from rating curve extended above 904 m.g.d.
Extreme minimum discharge - 12 m.g.d. Jan. 2, 1940 (gage height - 0.54 foot), result of low temperature.

Remarks - Slight diurnal fluctuation at low flow caused by small mill above station.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	1000	1290	762	507	795	704	743	1070
Maximum monthly discharge (c.f.s.)	1550	1990	1180	785	1230	1090	1150	1650
Mean monthly discharge (m.g.d.)	98.2	77.5	79.5	110	89.8	79.5	73.0	66.5
Mean monthly discharge (c.f.s.)	152	120	123	171	139	123	113	103
Minimum monthly discharge (m.g.d.)	24	17	20	44	25	25	18	15
Minimum monthly discharge (c.f.s.)	37	26	31	68	39	39	28	23
Maximum mean weekly discharge (m.g.d.)	401	558	351	253	341	303	314	388
Minimum mean weekly discharge (m.g.d.)	25	18	23	49	28	26	19	16
Maximum mean weekly discharge (c.f.s.)	620	864	543	357	528	469	486	601
Minimum mean weekly discharge (c.f.s.)	38	28	35	76	43	40	30	24

Little River near Penrose, Transylvania County

Location - Water-stage recorder, 0.4 mile downstream from Cascade Lake Dam, 1.2 miles upstream from Hart Branch, 2.2 miles upstream from Crab Creek, and 3.3 miles south of Penrose. Datum of gage is 2,099.60 feet above mean sea level.

Drainage area - 41.4 square miles.

Records available - October 1942 to date.

October 1942 to December 1945

Extreme maximum discharge - 1,760 m.g.d. Dec. 29, 1942 (gage height - 9.44 feet).
Extreme minimum and minimum daily discharge - 0.19 m.g.d. (regulated) Oct. 24, 1943 (gage height - 0.18 foot).

Remarks - Considerable diurnal fluctuations and some regulation at low flow caused by small power plant above station.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	859	579	749	1070	1060	743	1490	1190
Maximum monthly discharge (c.f.s.)	1330	896	1160	1650	1640	1150	2310	1840
Mean monthly discharge (m.g.d.)	113	86.6	115	152	100	74.9	89.1	88.5
Mean monthly discharge (c.f.s.)	175	134	178	235	155	116	138	137
Minimum monthly discharge (m.g.d.)	4.07	0.90	4.46	7.8	1.29	3.62	0.84	0.45
Minimum monthly discharge (c.f.s.)	6.3	1.4	6.9	12	2.0	5.6	1.3	0.7
Maximum mean weekly discharge (m.g.d.)	425	273	388	345	278	281	369	410

	1946	1947	1948	1949	1950	1951	1952	1953
Minimum mean weekly discharge (m.g.d.)	30	16	35	76	45	19	15	20
Maximum mean weekly discharge (c.f.s.)	658	401	601	534	431	345	571	634
Minimum mean weekly discharge (c.f.s.)	46	24	54	117	70	29	23	31

Mills River near Mills River, Henderson County

Location - Water-stage recorder at ford 1.5 miles downstream from confluence of North and South Forks, 2 miles upstream from village of Mills River, and 4.5 miles northwest of Horseshoe. Datum of gage is 2,088.47 feet above mean sea level.

Drainage area - 66.7 square miles.

Records available - September 1924 to September 1926, May 1934 to date.

September 1924 to September 1926, May 1934 to December 1945

Average discharge - 99.3 m.g.d.
Extreme maximum discharge - 6,500 m.g.d. Aug. 30, 1940, (gage height - 13.62), from rating curve extended above 1,680 m.g.d. on basis of studies by Tennessee Valley Authority.
Extreme minimum discharge - 10 m.g.d. Dec. 24, 1943 (gage height - 1.34 feet), result of low temperature
The City of Hendersonville diverted, for water supply, an average of 1.16 m.g.d.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	769	963	904	1460	995	594	1160	1090
Maximum monthly discharge (c.f.s.)	1190	1490	1400	2260	1540	920	1790	1680
Mean monthly discharge (m.g.d.)	128	87.9	124	168	116	93.7	107	80.1
Mean monthly discharge (c.f.s.)	198	136	192	260	180	145	165	124
Minimum monthly discharge (m.g.d.)	31	19	41	78	43	25	25	17
Minimum monthly discharge (c.f.s.)	48	30	64	120	67	38	38	26
Maximum mean weekly discharge (m.g.d.)	450	346	427	387	349	256	477	390
Minimum mean weekly discharge (m.g.d.)	34	21	50	81	50	26	27	18
Maximum mean weekly discharge (c.f.s.)	697	534	654	599	540	397	739	603
Minimum mean weekly discharge (c.f.s.)	52	32	77	126	77	41	42	28

Mud Creek at Naples, Henderson County

Location (revised) - Water-stage recorder at bridge on old Asheville-Hendersonville highway, 100 feet downstream from Byers Creek, 0.8 mile south of Naples, and 2.2 miles upstream from mouth. Datum of gage is 2,047.48 feet above mean sea level.

Drainage area - 109 square miles.

Records available - May to December 1907, September 1938 to date.

May to December 1907, September 1938 to December 1945

Extreme maximum discharge - 7,000 m.g.d. Aug. 13, 1940 (gage height - 13.07 feet).
Extreme minimum discharge - 19 m.g.d. Sept. 17, Oct. 15, Oct. 28, and Dec. 6, 1907.
Floods of July 1916 and August 1928 reached stages of 21 feet and 15 feet, respectively, from information by Tennessee Valley Authority.
Mud Creek received sewage from City of Hendersonville, which diverts its water supply from tributaries of Mills River.

Remarks - Several small artificial ponds may produce slight regulation.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	1230	924	1510	2140	2120	950	2320	1560
Maximum monthly discharge (c.f.s.)	1900	1430	2340	3320	3280	1470	3540	2410
Mean monthly discharge (m.g.d.)	155	123	153	209	162	110	125	98.8
Mean monthly discharge (c.f.s.)	240	191	237	324	250	170	193	153
Minimum monthly discharge (m.g.d.)	51	38	50	95	67	36	33	27
Minimum monthly discharge (c.f.s.)	79	59	78	147	103	56	51	42
Maximum mean weekly discharge (m.g.d.)	477	488	456	678	749	398	616	479
Minimum mean weekly discharge (m.g.d.)	54	39	61	97	80	37	39	32
Maximum mean weekly discharge (c.f.s.)	738	756	706	1050	1160	616	953	742
Minimum mean weekly discharge (c.f.s.)	84	61	94	154	124	58	59	49

Nolichucky River at Poplar, Mitchell County

Location - Water-stage recorder at Poplar, 3.9 miles downstream from Cane River and 6.1 miles upstream from North Carolina-Tennessee State Line. Datum of gage is 1,971.96 feet above mean sea level.

Drainage area - 608 square miles.

Records available - July 1925 to date.

July 1925 to December 1945

Average discharge - 668 m.g.d.
Extreme maximum discharge - 48,100 m.g.d. Aug. 13, 1940 (gage height - 19.7 feet), by slope-area method.
Extreme minimum discharge - 57 m.g.d. Sept. 7, 1925.
Floods of 1901 and 1916 reached a stage slightly over 21 feet, from floodmarks.

Remarks - Some diurnal fluctuation caused by mills above station.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	8790	6910	3720	8010	7560	3890	3430	7430
Maximum monthly discharge (c.f.s.)	13600	10700	5760	12400	11700	6020	5310	11500
Mean monthly discharge (m.g.d.)	705	646	683	972	753	532	479	484
Mean monthly discharge (c.f.s.)	1092	1000	1058	1505	1165	823	741	749
Minimum monthly discharge (m.g.d.)	158	170	187	382	220	127	112	91
Minimum monthly discharge (c.f.s.)	244	263	290	592	340	196	174	141
Maximum mean weekly discharge (m.g.d.)	3210	2650	2380	2820	2520	1510	1650	2450
Minimum mean weekly discharge (m.g.d.)	189	198	220	413	262	136	130	103
Maximum mean weekly discharge (c.f.s.)	4970	4100	3690	4370	3900	2340	2560	3800
Minimum mean weekly discharge (c.f.s.)	292	307	344	640	406	210	201	164

North Fork Swannanoa River near Black Mountain, Buncombe County

Location - Water-stage recorder and concrete control, 0.25 mile downstream from emergency pumping plant of Asheville Water Department, 1.9 miles downstream from Sugar Fork, 3 miles northwest of town of Black Mountain, and 3.4 miles downstream from Right Fork. Datum of gage is 2,428.03 feet above mean sea level.

Drainage area - 23.8 square miles.

Records available - January 1926 to date.

Average discharge - 31.0 m.g.d.
Extreme maximum discharge - 5,300 m.g.d. Aug. 13, 1940 (gage height - 8.55 feet), by slope area method.
Extreme minimum discharge - 0.47 m.g.d. July 20 and 21, 1926 (gage height - 0.88 feet).
City of Asheville diverted part of its water supply 3 miles above station. For information regarding discharges into Beetree Reservoir, see page 77, "Hydrologic Data on the French Broad River Basin, 1857-1945", North Carolina Department of Conservation and Development, 1950.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	514	717	447	1800	643	203	432	645
Maximum monthly discharge (c.f.s.)	796	1110	692	2780	995	315	668	999
Mean monthly discharge (m.g.d.)	33.6	32.5	33.3	60.6	36.5	20.8	22.1	24.7
Mean monthly discharge (c.f.s.)	52.0	50.3	51.5	92.9	56.2	32.2	34.2	38.2
Minimum monthly discharge (m.g.d.)	1.55	1.23	2.07	9.7	3.04	1.23	1.10	0.517
Minimum monthly discharge (c.f.s.)	2.4	1.9	3.2	15	4.7	1.9	1.7	0.8

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum mean weekly discharge (m.g.d.)	168	174	149	335	218	78	136	187
Minimum mean weekly discharge (m.g.d.)	1.85	1.72	3.23	12	3.81	1.29	1.16	.607
Maximum mean weekly discharge (c.f.s.)	260	270	230	518	337	121	211	289
Minimum mean weekly discharge (c.f.s.)	2.86	2.67	5.0	19	5.8	1.99	1.84	0.94

North Toe River at Altapass, Mitchell County

Location - Water-stage recorder, 0.1 mile upstream from Rose Creek and 1 mile north of Altapass. Datum of gage is 2,542.91 feet above mean sea level.

Drainage area - 104 square miles (111 square miles prior to Oct. 1938).

Records available - October 1938 to date. May 1934 to September 1938 at site 1.2 miles downstream, published as North Toe River above Spruce Pine.

May 1934 to December 1945

Average discharge - 113 m.g.d.
Extreme maximum discharge - 14,300 m.g.d. Aug. 13, 1940 (gage height - 19.5 feet, from floodmark in gage well), by slope-area method.
Extreme minimum discharge - 15 m.g.d. Dec. 14 and 15, 1939, result of low temperature.
Extreme minimum daily discharge - 24 m.g.d. Oct. 16, 1941.

Remarks - Slight diurnal fluctuation at low flow caused by gristmills above station.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	1320	1270	814	1530	1520	584	788	1240
Maximum monthly discharge (c.f.s.)	2050	1960	1260	2370	2360	904	1220	1920
Mean monthly discharge (m.g.d.)	132	124	129	176	130	100	91.7	101
Mean monthly discharge (c.f.s.)	204	192	200	273	201	155	142	157
Minimum monthly discharge (m.g.d.)	30	33	41	72	44	25	22	22
Minimum monthly discharge (c.f.s.)	46	51	64	111	68	38	34	34
Maximum mean weekly discharge (m.g.d.)	568	441	429	567	529	316	326	451
Minimum mean weekly discharge (m.g.d.)	34	39	47	78	49	27	25	25
Maximum mean weekly discharge (c.f.s.)	880	683	664	877	819	489	504	698
Minimum mean weekly discharge (c.f.s.)	53	61	72	121	76	42	38	38

Pigeon River at Canton, Haywood County

Location (revised) - Water-stage recorder, 0.5 mile upstream from bridge on U. S. Highways 19 and 23 at Canton. Datum of gage is 2,572.22 feet above mean sea level.

Drainage area - 133 square miles.

Records available - May 1907 (fragmentary) and December 1928 to date in reports of U. S. Geological Survey. May 1907 (complete) in North Carolina Department of Conservation and Development Bulletin 34 and Tennessee Division of Geology Bulletin 34.

June 1907 to June 1909 and December 1945

Average discharge - 197 m.g.d.
Extreme maximum discharge - 20,400 m.g.d. Aug. 30, 1940 (gage height - 20.85 feet), from floodmark in gage well.
Extreme minimum discharge - 16 m.g.d. Dec. 24, 1943 (gage height - 0.30 foot), result of low temperature.
Extreme minimum daily discharge - 28 m.g.d. Oct. 26, 1941 and Dec. 17, 1943.

Remarks - Occasional diurnal fluctuation and slight regulation caused by gristmill and small reservoir above station.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	2030	2960	2130	4430	2890	1940	2600	2800
Maximum monthly discharge (c.f.s.)	3150	4580	3300	6850	4470	3010	4020	4340
Mean monthly discharge (m.g.d.)	231	193	252	306	222	173	192	163
Mean monthly discharge (c.f.s.)	357	299	290	474	344	268	297	253
Minimum monthly discharge (m.g.d.)	38	35	54	107	41	37	37	24
Minimum monthly discharge (c.f.s.)	59	54	83	166	63	58	58	37
Maximum mean weekly discharge (m.g.d.)	827	1000	875	973	866	704	956	956
Minimum mean weekly discharge (m.g.d.)	45	44	65	118	45	39	43	28
Maximum mean weekly discharge (c.f.s.)	1280	1550	1350	1510	1340	1090	1480	1480
Minimum mean weekly discharge (c.f.s.)	69	68	101	183	70	61	67	44

Pigeon River near Hepco, Haywood County

Location - Water stage recorder, 0.8 mile downstream from Jonathan Creek and 2.4 miles upstream from Fines Creek and Hepco. Datum of gage is 2,335.95 feet above mean sea level.

Drainage area - 350 square miles.

Records available - July 1927 to date.

July 1927 to December 1945

Extreme maximum discharge - 21,100 m.g.d. Aug. 30, 1940 (gage height - 15.82 feet, from floodmark in gage house), from rating curve extended above 3,850 m.g.d. on basis of slope-area determinations at gage heights 14.94 and 15.84 feet.
Extreme minimum discharge - 52 m.g.d. Sept. 30, 1941 (gage height - 0.82 foot).

Remarks - Occasional slight regulation at low flow by small reservoirs above station.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	5100	5720	3230	6270	3370	3820	4240	4900
Maximum monthly discharge (c.f.s.)	7890	8850	5000	9700	5220	5910	6560	7580
Mean monthly discharge (m.g.d.)	488	384	455	590	440	374	383	316
Mean monthly discharge (c.f.s.)	755	595	705	913	682	579	593	489
Minimum monthly discharge (m.g.d.)	114	84	111	251	111	84	90	68
Minimum monthly discharge (c.f.s.)	177	130	172	388	172	130	140	105
Maximum mean weekly discharge (m.g.d.)	1790	2200	1680	1490	1450	1430	1700	1750
Minimum mean weekly discharge (m.g.d.)	122	87	127	274	76	88	94	71
Maximum mean weekly discharge (c.fls.	2770	3410	2600	2310	2240	2210	2630	2710
Minimum mean weekly discharge (c.f.s.)	189	135	197	424	118	136	146	110

Sandymush Creek near Alexander, Buncombe County

Location - Water-stage recorder, 0.7 mile downstream from Turkey Creek, 1.3 miles upstream from mouth, and 3.5 miles northeast of Alexander. Datum of gage is 1,732.53 above mean sea level.

Drainage area - 79.5 square miles.

Records available - December 1942 to date.

December 1942 to December 1945

Extreme maximum discharge - 2,550 m.g.d. July 20, 1944 (gage height - 7.75 feet), from rating curve extended above 452 m.g.d.
Extreme minimum discharge - 7.8 m.g.d. Dec. 24, 1943 and Jan. 31, 1945, result of low temperature.
Extreme minimum gage height - 2.17 feet Dec. 24, 1943.
Flood of Aug. 30, 1940 reached a stage of 16.7 feet, from floodmarks.

Remarks - Records good except those for periods of ice effect or no gage-height record, which are fair.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	1710	840	704	717	592	355	606	561
Minimum monthly discharge (c.f.s.)	2650	1300	1090	1110	917	550	938	868
Mean monthly discharge (m.g.d.)	56.3	32.9	36.4	57.2	42.2	34.2	31.3	23.3
Mean monthly discharge (c.f.s.)	87.1	50.9	56.4	88.6	65.3	53.0	48.4	36.0
Minimum monthly discharge (m.g.d.)	12	9.0	8.4	20	14	10	7.1	3.0

	1946	1947	1948	1949	1950	1951	1952	1953
Minimum monthly discharge (c.f.s.)	18	14	13	31	22	16	11	4.7
Maximum mean weekly discharge (m.g.d.)	344	251	180	180	189	116	198	158
Minimum mean weekly discharge (m.g.d.)	12	9.7	10	26	16	10	7.8	3.36
Maximum mean weekly discharge (c.f.s.	533	389	278	278	293	180	307	244
Minimum mean weekly discharge (c.f.s.)	19	15	16	40	25	16	12	5.2

South Toe River at Newdale, Yancey County

Location - Water-stage recorder at bridge on U. S. Highway 19E at Newdale, 1.25 miles upstream from Little Crabtree Creek and 6.25 miles east of Burnsville. Datum of gage is 2,443.98 feet above mean sea level.

Drainage area - 60.8 square miles.

Records available - May 1934 to date.

May 1934 to December 1945

Average discharge - 107 m.g.d.
Extreme maximum discharge - 19000 m.g.d. Aug. 13, 1940 (gage height - 17.4 feet), from rating curve extended above 2,300 m.g.d. on basis of discharge measurements at gage height 16.9 and contracted opening determination at gage height of 17.4 feet.
Extreme minimum discharge - 5.0 m.g.d. Oct. 20-23 and Nov. 30, 1943 (gage height - 1.13 feet).
Extreme minimum daily discharge - 7.8 m.g.d. June 21, 1941 and Sept. 19, 1943.

Remarks - Considerable diurnal fluctuation at medium and low flow caused by power plants above station.

	1946	1947	1948	1949	1950	1951
Maximum monthly discharge (m.g.d.)	1390	1820	1930	3710	2290	969
Maximum monthly discharge (c.f.s.)	2150	2810	2980	5740	3550	1500
Mean monthly discharge (m.g.d.)	114	116	132	182	137	80.8
Mean monthly discharge (c.f.s.)	176	179	204	281	212	125
Minimum monthly discharge (m.g.d.)	19	23	30	63	31	15
Minimum monthly discharge (c.f.s.)	30	35	47	98	48	23
Maximum mean weekly discharge (m.g.d.)	530	618	439	820	833	315
Minimum mean weekly discharge (m.g.d.)	23	24	34	67	37	16
Maximum mean weekly discharge (c.f.s.)	821	957	679	1270	1290	487
Minimum mean weekly discharge (c.f.s.)	35	37	52	103	57	25

Swannanoa River at Biltmore, Buncombe County

Location (revised) - Water-stage recorder and masonry control at Biltmore, 100 feet downstream from Biltmore Avenue Bridge, 200 feet upstream from Southern Railway Bridge, and 1.6 miles upstream from mouth. Datum of gage is 1,976.58 feet above mean sea level.

Drainage area - 130 square miles.

Records available - December 1920 to September 1926, May 1934 to date.

December 1920 to September 1926, May 1934 to December 1945

Average discharge - 101 m.g.d.
Extreme maximum discharge - 11,900 m.g.d. Aug. 13, 1940 (gage height - 19.00 feet), by computation of flow over dam 3 miles above station.
Extreme minimum discharge - 0.17 m.g.d. (regulated) Oct. 9, 14, and 15, 1941.
Extreme minimum daily discharge - 0.78 m.g.d. (regulated) Oct. 14, 1941.
Extreme minimum gage height - 0.65 foot July 17, 1936.
Maximum stage known - 21.5 feet July 1916, from flood marks. Flood of Aug. 16, 1928 reached a stage of 18.74 feet, from floodmarks. Extremely high stages subject to backwater from French Broad River.

Remarks - Occasional large diurnal fluctuation and regulation from Lake Craig in recreation park 3 miles above station. City of Asheville diverted its water supply above this station from Beetree Reservoir (capacity - 700,000 gallons) and North Fork Swannanoa River.

	1946	1947	1948	1949	1950	1951	1952	1953
Maximum monthly discharge (m.g.d.)	1220	1290	756	1690	1470	537	1500	1650
Maximum monthly discharge (c.f.s.)	1890	1990	1170	2610	2270	831	2320	2550
Mean monthly discharge (m.g.d.)	118	96.3	105	184	120	73.6	82.0	71.7
Mean monthly discharge (c.f.s.)	183	149	163	285	185	114	127	111
Minimum monthly discharge (m.g.d.)	17	16	19	37	22	11	12	3.10
Minimum monthly discharge (c.f.s.)	26	25	29	57	34	17	19	4.8
Maximum mean weekly discharge (c.f.s.)	788	732	676	896	828	360	787	772
Minimum mean weekly discharge (c.f.s.)	26	28	36	89	40	19	25	9.9
Maximum mean weekly discharge (m.g.d.)	509	473	437	579	535	223	508	499
Minimum mean weekly discharge (m.g.d.)	17	18	23	57	26	12	16	6.4

Lakes, Ponds, and Reservoirs - Examination of North Carolina State Highway and Public Works Commission maps indicates that the following lakes, ponds, and reservoirs are located in the French Broad River Basin in North Carolina.

County	Name	Stream on which located
Avery	none	
Buncombe	Lake Powhatan	Bent Creek
Buncombe	Lake Ashnoca	Ragsdale Creek
Buncombe	Lake Craig	Swannanoa River
Buncombe	Busbee Reservoir	Unnamed tributary of Swannanoa River near Biltmore Forest.
Buncombe	Lake Louise	Reems Creek
Buncombe	Assembly Lake	Unnamed tributary of Swannanoa River near Ridgecrest
Buncombe	Beaver Lake	Unnamed tributary of French Broad River on western edge of Asheville
Buncombe	Black Mountain Reservoir	Unnamed Tributary of Swannanoa River
Haywood	Waterville Lake	Pigeon River
Haywood	Lake Junaluska	Richland Creek
Henderson	Unnamed lake at Camp Carlyle near Hendersonville	Devils Fork
Henderson	Unnamed lake	Meminger Creek near Flat Rock
Henderson	Highland Lake	King Creek
Henderson	Lake Osceola	Unnamed tributary of Mud Creek
Madison	none	
Mitchell	none	
Transylvania	Cascade Lake	Little River
Transylvania	Unnamed lake in Pisgah National Forest	Bushy Creek

Geology and Ground Water in the Mountain Section - The following information is extracted from Bulletin 47, published in 1950 by the Division of Mineral Resources, North Carolina Department of Conservation and Development, prepared in cooperation with the Geological Survey, United States Department of the Interior, and entitled "Progress Report on Ground Water in North Carolina by M. J. Mundorff".

Little detailed information is available regarding ground-water supplies and conditions in the Mountain section of the State. Surface supplies generally have been satisfactory in this area, but ground water has the advantage of a constant supply and temperature so that it is preferred at many places.

The rocks of the Mountain section of North Carolina have been divided into three main unit-areas on the basis of their hydrologic properties.

Unit-area 7 includes parts of Avery, Haywood, and Madison Counties, and Unit-areas 8 and 9 include parts of all of the eight counties lying wholly or partially within the French Broad River Basin. The parts of the eight counties included in the three unit-areas are shown on the map accompanying Bulletin 47, Plate 1.

Unit area 7 consists of rocks, chiefly of sedimentary origin, which have been only slightly or moderately metamorphosed. Included in these rocks are schists, phyllites, slates, shales, quartzites, limestones, and marbles. Bedding planes are distinct in most of the formations of this group.

The rocks of this unit are fairly good aquifers. The harder and coarser grained formations generally yield larger supplies than those of softer and finer grain. Because a considerable amount of the water moves along the bedding and cleavage planes, the most productive wells are in areas where these planes are only moderately tilted. Thus, a well of given depth will intersect more planes than it would in an area where the planes are steeper.

Unit-area 8 includes the highly metamorphosed mica-gneisses and schists of the Carolina gneiss, similar rocks which are also chiefly of sedimentary origin.

Because ground water occurs and moves in joints and other fractures, and along the cleavage and bedding planes in the rocks of western North Carolina, some of the best aquifers are the highly metamorphosed rocks included in the Carolina gneiss. The more productive wells in Unit-area 8, as in Unit-area 7, are generally located where the dip of the bedding and schistosity is moderately low.

Unit-area 9 consists of granites and gneisses of igneous origin, representing a wide range in age and a corresponding range in degree of metamorphism. The formations of this unit-area include the Whiteside, Yorkville, and similar granites which are only slightly, or moderately, metamorphosed; and the Cranberry, Beech, and Henderson granites and the Blowing Rock and Roan gneisses which have been greatly metamorphosed.

The range in the yield of wells in this unit-area is large. Generally, the more intensely sheared rocks will yield the largest amounts; very often, wells in unsheared granites will be failures. The areas of sheared and shattered rocks are more easily eroded than areas of unbroken rock, and, therefore,

hills and ridges in granite areas generally indicate that the rock beneath is relatively unfractured. Such locations are undesirable as well sites.

The following information is shown on the map accompanying Bulletin 47, plate I, referred to above:

Unit-area 7

Albite-chlorite schist, quartzite, slate, shale, and limestone. Chiefly derived from sedimentary formations. Bedding usually distinct. Pre-Cambrian and Cambrian age.

Unit-area 8

Gneiss and schist, chiefly fieldspar-biotite gneiss and schist included in the Carolina gneiss. Derived principally from sedimentary rocks. Pre-Cambrian age. Generally moderate supplies of water, which is soft."

Moderate to moderately large amounts of water. Industrial and municipal wells average about 50 gallons a minute. Best supplies obtained in coarser phases where dip is fairly low. Water soft to moderately hard.

Unit-area 9

Granites and gneisses, slight to severe metamorphism. Includes Cranberry granite, Henderson granite, Bessemer granite, Whiteside and Yorkville granites, and similar rocks of igneous origin.

Generally small, sometimes moderate, rarely moderately large, supplies of water. Best supplies are from more highly metamorphosed rocks. Only a few gallons a minute from wells in unsheared rocks. Water moderately soft to hard.

Flood-plain deposits - One possible source of ground-water supply in this part of the State has been generally overlooked. This source is the gravel and sand of the flood-plain deposits, along the creeks and rivers. The logs of the wells of the Champion Fibre Company indicate a considerable thickness of sand and gravel in the valley of the Pigeon River at Canton, and it is probable that flood-plain deposits along many of the streams will yield moderate supplies of ground water. It is possible that average millions a day could be obtained in some of the larger stream valleys by utilizing groups or lines of shallow wells.

RECORDS OF WELLS IN THE FRENCH BROAD RIVER BASIN

Location	Owner	Depth (ft.)	Diam. (in.)	Topographic Location	Chief Aquifer	Yield (g.p.m.)
Henderson County						
Hendersonville, 7 miles N of	Biltmore Hosiery Company	100	6	Valley	Henderson (?) granite	25
Haywood County						
Hazlewood	Hazlewood Tannery	60	6	Valley		30
Hazlewood, near Golf Club	Town	400-500	6?	Valley	Roan(?) gneiss	0

RECORDS OF WELLS IN THE FRENCH BROAD RIVER BASIN (Continued)

Location	Owner	Depth	Diam.	Topographic Location	Chief Aquifer	Yield (g.p.m.)
Haywood County						
Canton, at E.B. Plant	Champion Fibre Company	168-220	6	Valley	Carolina gneiss	av. 65
Canton, at Sulfur storage plant	Champion Fibre Company	86	6	Valley	Carolina gneiss	?
Canton, at Sulfur storage plant	Champion Fibre Company	202	6	Valley	Carolina gneiss	90
Canton, South of Book Mill	Champion Fibre Company	146-152	6	Valley	Carolina gneiss	?
Buncombe County						
Enka, 10 miles W of Asheville	American Enka Corporation	400-500	10	Valley	Carolina gneiss	300 (2 wells)
Asheville	Eliada Orphanage	56	6		Carolina gneiss	20
Avery County						
Newland, 0.5 mile NW of	Town	150	6	Slope	Shale (Cambrian?)	60

Public Water Supplies - - Descriptions and chemical character of public supplies of water, both surface water and ground water, are contained in Chapter II of this publication.

Chemical Character of Surface Waters - - The following material, taken from Bulletin 52, Volumes 1-10, inclusive, published by the North Carolina Department of Conservation and Development, and prepared cooperatively by the Geological Survey, U. S. Department of the Interior, comprises analyses of samples of surface waters in the French Broad River Basin in North Carolina, collected, during the period from October 1, 1944 to September 30, 1954, daily for some stations, and monthly for other stations, at or near points where continuous stream-measurement stations were maintained. In addition to the daily and monthly samples, samples were also collected periodically at miscellaneous stream-measurement sites. This additional data made it possible to predict the chemical character of the stream at various points within the French Broad River Basin. Information regarding definitions and limits of tolerance, pertaining to hardness, conductivity, pH, suspended matter, color, oxygen consumed, dissolved solids, and other characteristics of quality of water as determined by chemical analyses, may be found on pages 80-84, inclusive, "Water Resources of North Carolina", published by the North Carolina Department of Conservation and Development in January, 1955.

Avery Creek near Avery Creek

Date	4-19-48	Bicarbonate	8
Color	3	Sulfate	1.2
pH	7.2	Chloride	.8
Silica	8.0	Fluoride	.1
Iron	.04	Nitrate	.1
Calcium	1.3	Dissolved solids	20
Magnesium	.4	Total hardness	5
Na + K	2.0		

Allen Creek near Hazelwood

Date	3-28-47	Bicarbonate	8.0
Color	6	Sulfate	1.6
pH	6.15	Chloride	0.6
Silica	6.9	Fluoride	0.1
Iron	.02	Nitrate	0.4
Calcium	1.6	Dissolved solids	18
Magnesium	0.6	Total hardness	6
Na + K	1.4		

Beaver Creek near Spruce Pine

Date	1-22-47	Bicarbonate	7.0
Color	14	Sulfate	2.2
pH	6.95	Chloride	.8
Silica	6.9	Fluoride	.1
Iron	.06	Nitrate	.6
Calcium	1.8	Dissolved solids	19
Magnesium	1.0	Total hardness	9
Na + K	.6		

Beetree Creek near Swannanoa

Date	4-14-45	Na + K	2.1
Mean Discharge (c.f.s.)	9.1	Bicarbonate	7.0
Suspended matter	1	Sulfate	3.1
Color	4	Chloride	.9
Silica	7.9	Fluoride	.0
Iron	.01	Nitrate	.1
Calcium	1.3	Dissolved solids	20
Magnesium	.6	Total hardness	6

Bent Creek at Bent Creek

Date	4-19-48	Bicarbonate	8
Color	2	Sulfate	1.3
pH	6.3	Chloride	.8
Silica	7.1	Fluoride	.1
Iron	.08	Nitrate	.1
Calcium	1.0	Dissolved solids	17
Magnesium	.7	Total hardness	5
Na + K	1.8		

Big Laurel Creek near Stackhouse

Date	Average of daily samples Oct.1,1951-Sept.30,1952,incl.	5-9-45	4-20-48
Mean discharge,c.f.s.	153	235	145
Temperature	49		
Silica	11	9.3	11
Iron	.06	.03	.02
Calcium	3.8	2.7	3.3
Magnesium	1.2	1.0	1.1
Na + K	3.5	3.0	2.5
Bicarbonate	19	16	16
Sulfate	3.1	2.5	2.9
Chloride	1.5	.6	.8
Fluoride	.1	.1	.2
Nitrate	.7	.6	.4
Dissolved solids	37	28	33
Total hardness	14	11	13
Specific conductance	46.1		
pH	6.8		7.6
Oxygen consumed			
Unfiltered	3.7		
Filtered	2.2		
Suspended matter	54	30	
Color	8	8	7

Big Pine Creek at Barnard

Date	4-20-48	Bicarbonate	19
Color	8	Sulfate	3.8
pH	7.5	Chloride	1.1
Silica	13	Fluoride	.2
Iron	.03	Nitrate	1.1
Calcium	3.7	Dissolved solids	41
Magnesium	1.1	Total hardness	14
Na + K	4.0		

Black Mountain Reservoir at Black Mountain

Date	3-2-45	Bicarbonate	12
Color	7	Sulfate	2.0
Suspended matter	2	Chloride	.6
Silica	7.9	Fluoride	.0
Iron	.02	Nitrate	.1
Calcium	1.8	Dissolved solids	23
Magnesium	.6	Total hardness	7
Na + K	2.7		

Boylston Creek near Horse Shoe

Date	3-8-45	4-19-48
Mean Discharge c.f.s.	31	35
Suspended matter	4	4
Silica	6.5	6.3
Iron	.03	.01
Calcium	2.4	1.2
Magnesium	1.0	.6
Na + K	2.0	2.2
Bicarbonate	13	9
Sulfate	1.9	1.2
Chloride	.9	.9
Fluoride	.1	.1
Nitrate	.4	.4
Dissolved solids	22	18
Total hardness	10	5
pH		7.0

Cane Creek at Fletcher

Date	4-19-48	Na + K	2.6
Mean discharge, c.f.s.	79	Bicarbonate	16.
Color	6	Sulfate	1.9
pH	7.6	Chloride	1.1
Silica	12	Fluoride	.1
Iron	.06	Nitrate	.2
Calcium	2.9	Dissolved solids	31
Magnesium	1.0	Total hardness	11

Cane River near Burnsville

Date	2-27-47	Bicarbonate	9.0
Mean discharge, c.f.s.	61.0	Sulfate	2.6
Color	7	Chloride	.8
pH	6.8	Fluoride	.1
Silica	7.0	Nitrate	1.0
Iron	.04	Dissolved solids	21
Calcium	1.6	Total hardness	7
Magnesium	.8		
Na + K	2.3		

Cataloochee Creek near Cataloochee

Date	4-2-45	Na + K	1.5
Mean discharge, c.f.s.	159	Bicarbonate	7.0
Suspended matter	17	Sulfate	1.2
Color	20	Chloride	.5
Silica	6.0	Fluoride	.0
Iron	.01	Nitrate	.2
Calcium	1.2	Dissolved solids	19
Magnesium	.4	Total hardness	5

Cane River near Sioux

	Average of daily samples, Oct.1,1951-Sept.30,1952,incl.	9-17-45
Mean discharge, c.f.s.	205	162
Temperature	55	
Silica	11	10
Iron	.06	.02
Calcium	3.5	2.6
Magnesium	1.2	1.1
Na + K	3.2	3.3
Bicarbonate	18	17
Sulfate	2.3	2.3
Chloride	1.5	.9
Fluoride	0.1	.0
Nitrate	0.9	.8
Dissolved solids	35	29
Total hardness	13	11
Specific conductance	42.5	
pH	6.8	
Oxygen consumed		
Unfiltered	3.5	
Filtered	2.2	
Suspended matter	24	6
Color	6	4

Catheys Creek near Brevard

	Average of monthly samples, Oct.1946-Sept. 1947	3-8-45
Mean discharge, c.f.s.	23.9	33
Color	9	5
pH	6.5	
Silica	6.9	5.7
Iron	.02	.02
Calcium	1.0	.6
Magnesium	.4	.4
Na + K	1.8	2.2
Bicarbonate	6.7	7.0
Sulfate	1.2	1.1
Chloride	.7	.5
Fluoride	.1	.1
Nitrate	.1	.1
Dissolved solids	17	14
Total hardness	4	3
Suspended matter		1

Clear Creek near Hendersonville

Date	9-26-45	Na + K	3.1
Mean Discharge, c.f.s.	59	Bicarbonate	13
Suspended matter	28	Sulfate	1.7
Color	3	Chloride	1.4
Silica	13	Fluoride	.0
Iron	.02	Nitrate	.4
Calcium	2.0	Dissolved solids	32
Magnesium	.7	Total hardness	8

Corner Rock Creek near Barnardsville

Date	6-19-53	Chloride	1.0
Discharge, c.f.s.	2.2	Total hardness	7
Bicarbonate	12	Specific conductance	25.9
Sulfate	1	pH	6.5

Crab Creek near Penrose

Date	3-9-45	4-19-48
Mean discharge, c.f.s.	26	34
Suspended matter	7	
Color	10	3
Silica	8.4	10
Iron	.04	.03
Calcium	.8	.8
Magnesium	.4	.3
Na + K	2.9	2.7
Bicarbonate	9.0	8
Sulfate	1.0	1.0
Chloride	.9	.8
Fluoride	.1	.1
Nitrate	.1	.1
Dissolved solids	20	20
Total hardness	4	3
pH		6.6

Crystal Falls Creek near Spruce Pine

Date	2-3-47	Bicarbonate	9.0
Color	5	Sulfate	2.3
pH	7.1	Chloride	2.0
Silica	8.1	Fluoride	.0
Iron	.05	Nitrate	.0
Calcium	1.4	Dissolved solids	21
Magnesium	.9	Total hardness	7
Na + K	2.5		

Davidson River near Brevard

Date	3-9-45	4-19-48
Mean discharge, c.f.s.	113	138
Suspended matter	0	
Color	7	3
Silica	5.9	7.0
Iron	.02	.01
Calcium	.9	.7

Davidson River near Brevard (Continued)

Magnesium	.4	.4
Na + K	2.0	1.7
Bicarbonate	7.0	6
Sulfate	1.4	1.2
Chloride	.5	.5
Fluoride	.1	.1
Nitrate	.1	.1
Dissolved solids	15	14
Total hardness	4	3
pH		6.8

French Broad River at Asheville

Averages of 22 10-day periods between October 1, 1950 and July 31, 1951 are shown on pages 18 and 19, Volume 7, Bulletin 52, North Carolina Department of Conservation and Development, published in July 1955. Results of miscellaneous analyses are shown below.

	8-9-45	4-19-48	8-23-51	9-6-51	9-26-51
Mean discharge, c.f.s.	1,190	3,020	890	857	668
Temperature			78	76	70
Suspended matter	46		28	46	6
Oxygen consumed					
Unfiltered			6.2	9.0	8.2
Filtered			3.8	6.4	5.2
Color	28	11	28	80	55
pH		6.4	6.2	6.7	6.4
Specific conductance			158	209	211
Silica	9.3	9.6	11	11	12
Iron	.06	.03	.08	.91	.15
Calcium	4.4	2.2	4.6	9.5	4.7
Magnesium	1.3	1.1	1.8	2.0	2.0
Na + K	19	12	24	31	32.2
Bicarbonate	34	19	25	48	27
Sulfate	17	15	39	48	58
Chloride	7.9	3.0	6.9	7.2	7.0
Fluoride	0.0	.2	.1	.0	.0
Nitrate	1.8	.7	.9	.1	.1
Dissolved solids	81	56	106	138	132
Total hardness	16	10	19	32	20

French Broad River at Bent Creek

Date	8-9-45	4-19-48
Mean Discharge, c.f.s.	1,000	1,730
Suspended matter	34	
Color	25	13
Silica	9.7	8.7
Iron	.01	.01
Calcium	3.4	2.2
Magnesium	.9	.5
Na + K	8.0	3.3
Bicarbonate	24	11
Sulfate	3.7	2.6
Chloride	4.2	1.9
Fluoride	.0	.1

French Broad River at Bent Creek (continued)

Nitrate	.4	.2
Dissolved solids	45	40
Total hardness	12	8
pH		6.4

French Broad River at Blantyre

	Average of daily samples Oct.1,1952-Sept.30,1953,incl.	3-9-45	4-19-48
Mean discharge,c.f.s.	846	848	1,070
Temperature	56		
Silica	9.1	7.1	8.2
Iron	.09	.06	.02
Calcium	4.9	2.6	1.7
Magnesium	0.8	.5	.4
Na + K	21	7.6	7.6
Bicarbonate	22	21	19
Sulfate	29	3.6	2.4
Chloride	5.5	2.9	2.8
Fluoride	0.0	.0	.1
Nitrate	0.4	.1	.2
Dissolved solids	98	40	34
Total hardness	15	9	6
Suspended matter	15	17	
Specific conductance	133		
pH	6.4		6.6
Color	45	38	23
Oxygen consumed			
Unfiltered	13		
Filtered	7.3		

French Broad River at Calvert

Date	3-8-45	4-19-48
Mean discharge, c.f.s.	302	399
Suspended matter	7	
Color	9	3
Silica	6.8	5.8
Iron	.05	.02
Calcium	1.0	.8
Magnesium	.3	.3
Na + K	2.6	3.0
Bicarbonate	8.0	8.0
Sulfate	1.2	1.2
Chloride	.8	.9
Fluoride	.1	.2
Nitrate	.1	.1
Dissolved solids	17	18
Total hardness	4	3
pH		6.9

French Broad River at Hot Springs

	Average of daily analyses Oct.1,1945-Sept.30,1946,incl.	5-8-45	4-20-48
Mean discharge,c.f.s.	3215	2400	2510

French Broad River at Hot Springs (continued)

Temperature	56		
Suspended matter	81	28	
Oxygen consumed			
Unfiltered	6.7		
Filtered	3.1		
Color	16	19	8
Silica	9.3	9.3	10
Iron	.05	.6	.03
Calcium	3.5	2.6	3.1
Magnesium	1.5	1.4	1.2
Na + K	11	9.1	9.6
Bicarbonate	18	13	14
Sulfate	17	16	17
Chloride	3.5	2.8	2.5
Fluoride	.1	.0	.2
Nitrate	1.2	1.1	.4
Dissolved solids	60	50	50
Total hardness	15	12	13
pH			7.2

French Broad River at Marshall

Date	5-7-45	4-20-48	4-21-49
Mean discharge, c.f.s.	2,330	2,350	2,820
Suspended matter	28		
Color	10	17	3
Silica	11	9.0	9.6
Iron	.07	.04	.02
Calcium	4.6	3.0	3.1
Magnesium	1.8	1.0	.2
Na + K	8.6	10	7.5
Bicarbonate	12	- -	14
Sulfate	23	17	9.8
Chloride	2.0	2.0	1.0
Fluoride	.1	.1	.1
Nitrate	.9	1.1	.5
Dissolved solids	60	57	42
Total hardness	19	12	9
pH		6.5	6.5
Specific conductance			52.4

French Broad River at Horse Shoe

Date	4-19-48	Bicarbonate	17
Color	17	Sulfate	2.1
pH	6.7	Chloride	2.2
Silica	8.1	Fluoride	.0
Iron	.02	Nitrate	.1
Calcium	1.8	Dissolved solids	32
Magnesium	.5	Total hardness	7
Na + K	5.9		

French Broad River at Rosman

	Average of daily samples, Oct.1,1945-Sept.30,1946,incl.	3-8-45	4-19-48
Mean discharge,c.f.s.	275	202	266
Temperature	51		
Suspended matter	22	6	
Oxygen consumed			
Unfiltered	3.6		
Filtered	1.8		
Color	6	8	2
Silica	6.3	5.9	7.4
Iron	.02	.04	.02
Calcium	1.2	.7	.8
Magnesium	.5	.3	.4
Na + K	2.0	2.3	3.2
Bicarbonate	8.0	7.0	8
Sulfate	1.4	1.1	1.8
Chloride	.8	.5	1.4
Fluoride	.1	.1	.1
Nitrate	.2	.1	.1
Dissolved solids	18	14	18
Total hardness	5	3	4
pH			7.0

Hominy Creek at Candler

Date	8-9-45	4-19-48
Mean discharge,c.f.s.	38	100
Suspended matter	45	7
Color	6	7.4
Silica	13	10
Iron	.03	.10
Calcium	3.8	2.8
Magnesium	1.4	.9
Na + K	4.9	2.7
Bicarbonate	24	14
Sulfate	3.2	2.7
Chloride	.1	.2
Fluoride	.1	.2
Nitrate	.6	.5
Dissolved solids	40	30
Total hardness	15	11
pH		7.4

Hunter Creek near Marshall

Date	9-10-46	Bicarbonate	23
Color	8	Sulfate	2.3
pH	7.1	Chloride	2.1
Silica	17	Fluoride	.1
Iron	.06	Nitrate	.0
Calcium	3.7	Dissolved solids	44
Magnesium	1.2	Total hardness	14
Na + K	4.7		

Ivy River near Marshall

Date	5-9-45	4-20-48	4-21-49
Mean discharge, c.f.s.	141	114	145
Suspended matter	17		
Color	6	7	2
Silica	13	12	12
Iron	.07	.06	.01
Calcium	3.6	4.2	4.0
Magnesium	1.7	1.6	.3
Na + K	3.4	3.2	4.7
Bicarbonate	22	23	19
Sulfate	3.0	3.0	3.0
Chloride	1.0	1.0	1.0
Fluoride	.1	.2	.1
Nitrate	.7	.3	.7
Dissolved solids	39	38	38
Total hardness	16	17	11
pH		7.6	6.8
Specific conductance			44.9

Jonathan Creek near Cove Creek

Date	4-2-45	4-21-49
Mean discharge, c.f.s.	236	144
Suspended matter	95	
Color	20	4
Silica	7.4	8.4
Iron	.07	.01
Calcium	1.6	1.6
Magnesium	.5	.3
Na + K	1.5	2.2
Bicarbonate	8.0	8.0
Sulfate	1.5	2.2
Chloride	.4	.5
Fluoride	.0	.0
Nitrate	.9	.7
Dissolved solids	24	22
Total hardness	6	5
pH		6.9
Specific conductance		21.2

Kings Creek near Brevard

Date	8-12-46	Bicarbonate	6.0
Color	7	Sulfate	.9
pH	7.6	Chloride	1.0
Silica	5.8	Fluoride	.1
Iron	.01	Nitrate	.0
Calcium	.7	Dissolved solids	16
Magnesium	.5	Total hardness	4
Na + K	1.7		

Little River near Penrose

Date	3-9-45	4-19-48
Mean discharge, c.f.s.	130	161
Suspended matter	3	

Little River near Penrose

Silica	6.5	6.8
Iron	.04	.02
Color	9	2
Calcium	.7	.6
Magnesium	.3	.2
Na + K	2.3	2.6
Bicarbonate	7.0	7.0
Sulfate	1.1	0.9
Chloride	.6	.6
Fluoride	.1	.1
Nitrate	.1	.1
Dissolved solids	15	16
Total hardness	3	2
pH		6.8

Martin Creek near Barnardsville

Date	6-19-53	Chloride	1.2
Discharge, c.f.s.	.474	Total hardness	8
Bicarbonate	11	Specific conductance	28.6
Sulfate	3	pH	6.1

Mills River near Mills River

	Average monthly analyses, Oct.1946-Sept.1947,incl.	Average of daily analyses, Oct.1,1951-Sept.30,1952,incl.	3-8-45	4-19-48
Mean discharge,c.f.s.	93.5	180	145	186
Color	11	6	8	4
pH	6.5	6.7		6.8
Silica	6.3	7.3	5.2	6.7
Iron	.03	.04	.03	.03
Calcium	1.1	1.5	.8	.5
Magnesium	.5	.4	.4	.4
Na + K	2.0	1.9	2.1	1.9
Bicarbonate	7.7	8.0	7.0	6.0
Sulfate	1.2	1.4	1.4	0.8
Chloride	.8	1.0	.5	.6
Fluoride	.1	.1	.1	.1
Nitrate	.1	.2	.1	.1
Dissolved solids	17	19	14	14
Total hardness	5	6	4	3
Temperature		52		
Specific conductance		19.2		
Oxygen consumed				
Unfiltered		3.5		
Filtered		2.3		
Suspended matter		7	3	

Newfound Creek near Alexander

Date	4-20-48	Bicarbonate	20
Color	2	Sulfate	3.3
pH	7.7	Chloride	1.4
Silica	14	Fluoride	0.1

Newfound Creek near Alexander (continued)

Iron	.14	Nitrate	0.6
Calcium	5.0	Dissolved solids	38
Magnesium	2.2	Total hardness	15
Na + K	3.5		

Mud Creek at Naples

Date	8-9-45	4-19-48
Mean discharge, c.f.s.	120	206
Suspended matter	54	
Color	6	3
Silica	12	11
Iron	.02	.01
Calcium	2.6	1.6
Magnesium	.9	.6
Na + K	4.5	3.7
Bicarbonate	17	13
Sulfate	2.2	1.4
Chloride	1.8	1.4
Fluoride	.1	.1
Nitrate	.1	.3
Dissolved solids	14	27
Total hardness	4	6
pH		6.7

Nolichucky River at Poplar

Date	9-27-45	Na + K	2.3
Mean Discharge, c.f.s.	764	Bicarbonate	15
Suspended matter	56	Sulfate	2.4
Color	6	Chloride	1.0
Silica	9.3	Fluoride	.0
Iron	.02	Nitrate	.4
Calcium	2.8	Dissolved solids	29
Magnesium	1.1	Total hardness	12

North Fork Mills River near Mills River

Date	2-25-47	Na + K	2.6
Measured discharge, c.f.s.	31.7	Bicarbonate	7.0
Color	7	Sulfate	1.5
pH	6.9	Chloride	.8
Silica	5.3	Fluoride	.2
Iron	.02	Nitrate	.0
Calcium	.7	Dissolved solids	14
Magnesium	.4	Total hardness	3

North Fork Swannanoa River near Black Mountain

Date	4-14-45	4-19-48
Mean Discharge, c.f.s.	31	40
Suspended matter	1	
Color	2	2
Silica	7.0	6.4
Iron	.01	.01
Calcium	1.4	2.0
Magnesium	.5	.5

North Fork Swannanoa River near Black Mountain (continued)

Na + K	1.7	1.3
Bicarbonate	8.0	8.0
Sulfate	1.6	1.6
Chloride	.6	.9
Fluoride	.0	.1
Nitrate	.2	.1
Dissolved solids	18	16
Total hardness	6	7
pH		7.1

North Toe River at Altapass

	Average of daily analyses, Oct.1,1948-Sept.30,1949,incl.	5-14-45
Mean discharge,c.f.s.	271	238
Temperature	53	
Suspended matter	75	21
Oxygen consumed		
Unfiltered	4.0	
Filtered	2.0	
Color	5	12
pH	6.7	
Specific conductance	33.2	
Silica	9.1	7.9
Iron	.04	.07
Calcium	2.7	2.2
Magnesium	1.1	1.0
Na + K	2.7	2.3
Bicarbonate	15	14
Sulfate	2.4	1.5
Chloride	1.5	.6
Fluoride	0.0	.0
Nitrate	0.8	.8
Dissolved solids	29	24
Total hardness	11	10

Pigeon River at Canton

Date	4-14-45	4-21-45
Mean discharge, c.f.s.	250	344
pH	- -	6.5
Color	7	2
Silica	6.2	7.8
Iron	.02	.01
Calcium	1.3	2.0
Magnesium	.6	.3
Na + K	2.2	1.1
Bicarbonate	9.0	7.0
Sulfate	1.6	1.9
Chloride	.0	.0
Nitrate	.3	.3
Dissolved solids	19	20
Total hardness	6	6
Specific conductance		17.7

Pigeon River near Hepco

Date	4-2-45	4-21-49
Mean discharge, c.f.s.	1,540	698
Suspended matter	325	
Color	42	27
Silica	7.7	8.1
Iron	.02	.09
Calcium	10	15
Magnesium	1.0	1.1
Na + K	11	16
Bicarbonate	38	41
Sulfate	7.6	12
Chloride	9.0	21
Fluoride	.1	.0
Nitrate	.4	.0
Dissolved solids	76	99
Total hardness	29	42
pH		6.3
Specific conductance		161

Piney Creek impounded at Montreat

Date	8-26-46	Bicarbonate	10
Color	13	Sulfate	1.7
pH	7.0	Chloride	1.8
Silica	8.1	Fluoride	.1
Iron	.27	Nitrate	.1
Calcium	1.5	Dissolved solids	23
Magnesium	.7	Total hardness	7
Na + K	2.9		

Reems Creek near Alexander

Date	4-20-48	Bicarbonate	20
Color	6	Sulfate	3.3
pH	7.4	Chloride	1.4
Silica	13	Fluoride	0.1
Iron	.06	Nitrate	0.6
Calcium	3.5	Dissolved solids	38
Magnesium	1.5	Total hardness	15
Na + K	3.5		

Reems Creek at Woodfin

Date	10-9-46	Bicarbonate	11
Color	13	Sulfate	1.8
pH	7.2	Chloride	1.0
Silica	8.1	Fluoride	.1
Iron	.04	Nitrate	.1
Calcium	1.4	Dissolved solids	22
Magnesium	.7	Total hardness	6
Na + K	2.9		

Reems Creek near Weaverville

Date	5-7-45		2-25-47
Mean discharge, c.f.s.	31.4	Measured discharge, c.f.s.	25.7
Suspended matter	16		

Reems Creek near Weaverville (continued)

Color	10	13
Silica	12	14
Iron	.08	.08
Calcium	2.4	2.6
Magnesium	1.0	1.4
Na + K	3.3	4.6
Bicarbonate	15	18
Sulfate	2.8	3.8
Chloride	1.2	1.5
Fluoride	.0	.2
Nitrate	.4	1.1
Dissolved solids	34	39
Total hardness	10	12
pH		7.2

Richland Creek at Hazelwood

Date	11-7-52	Chloride	2.0
Instantaneous discharge, c.f.s.	14.6	Total hardness	12
Bicarbonate	16	Specific conductance	42.5
Sulfate	3	pH	6.6

Richland Creek at Lake Junaluska

Date	3-28-47	Bicarbonate	14
Color	3	Sulfate	2.2
pH	7.1	Chloride	.1
Iron	.02	Nitrate	1.0
Calcium	2.6	Dissolved solids	28
Magnesium	1.0	Total hardness	11
Na + K	2.9		

Richland Creek at Waynesville

Date	4-2-45	Na + K	2.9
Mean discharge, c.f.s.	232	Bicarbonate	13
Suspended matter	478	Sulfate	2.5
Color	12	Chloride	.9
Silica	7.7	Fluoride	.1
Iron	.03	Nitrate	1.7
Calcium	2.6	Dissolved solids	27
Magnesium	.8	Total hardness	10

Sandymush Creek near Alexander

Date	5-7-45	Na + K	4.8
Mean discharge, c.f.s.	50	Bicarbonate	30
Suspended matter	17	Sulfate	2.8
Color	8	Chloride	1.0
Silica	16	Fluoride	.1
Iron	.08	Nitrate	.5
Calcium	4.4	Dissolved solids	47
Magnesium	2.0	Total hardness	19

South Fork Mill River at The Pink Beds

Date	3-9-45	Na + K	2.0

South Fork Mills River at The Pink Beds (continued)

Mean discharge, c.f.s.	29	Bicarbonate	6.0
Suspended matter	1	Sulfate	1.2
Color	7	Chloride	.5
Silica	5.5	Fluoride	.1
Iron	.03	Nitrate	.1
Calcium	.6	Dissolved solids	14
Magnesium	.3	Total hardness	3

South Toe River at Newdale

Date	5-14-45	Na + K	1.9
Mean discharge, c.f.s.	184	Bicarbonate	9.0
Suspended matter	7	Sulfate	1.7
Color	13	Chloride	.5
Silica	5.8	Fluoride	.0
Iron	.05	Nitrate	.3
Calcium	1.4	Dissolved solids	18
Magnesium	.6	Total hardness	6

Spring Creek at Hot Springs

Date	5-8-45	2-25-47	4-20-48
Mean discharge, c.f.s.	78.6	46.8	
Suspended matter	18		
Color	4	12	4
Silica	11	12	12
Iron	.03	.05	.04
Calcium	2.8	2.8	2.7
Magnesium	.9	1.0	1.0
Na + K	3.3	3.7	3.3
Bicarbonate	17	13	16
Sulfate	2.5	4.0	2.7
Chloride	.5	1.5	.9
Fluoride	.1	.3	.2
Nitrate	.5	1.8	.5
Dissolved solids	31	36	32
Total hardness	11	11	11
pH		7.2	7.0

Swannanoa River at Biltmore

Date	4-14-45	4-19-48
Mean discharge, c.f.s.	130	157
Suspended matter	8	
Color	6	4
Silica	8.5	9.8
Iron	.04	.06
Calcium	2.3	3.3
Magnesium	1.0	1.1
Na + K	3.8	7.6
Bicarbonate	13	23
Sulfate	3.2	4.1
Chloride	2.0	4.0
Fluoride	.0	.1
Nitrate	1.6	.3
Dissolved solids	32	43
Total hardness	10	13
pH		7.3

Walkers Branch near Burnsville

Date	6-19-53	Chloride	.5
Instantaneous discharge, c.f.s.	3.23	Total hardness	8
Bicarbonate	10	Specific conductance	24.0
Sulfate	2	pH	6.4

French Broad River Basin Pollution Survey Report - At a meeting of the State Stream Sanitation Committee on September 10, 1957, after discussion of the report, explanation of the findings during the study of the basin, and suggested classifications for the waters, the Committee adopted the report as presented and agreed to hold a public hearing regarding assignment of classifications to the waters in the French Broad River Basin at Asheville on October 24, 1957. The report contains information regarding sources of pollution in three drainage areas of the basin as follows:

Main Stem, French Broad River, and Tributaries - The French Broad River in North Carolina and some of its tributaries are used for sewage and waste disposal. Wastes are discharged into the drainage system at Rosman, Brevard, Pisgah Forest, Cranston Print Works, Biltmore Dairy Farm, Enka, Asheville, Mars Hill, Marshall and Hot Springs. The sources of pollution are described as follows:

Town of Rosman has no sewerage system; however, raw sewage from the Rosman School and a few houses is discharged into French Broad River. This waste should receive some treatment.

Toxaway Tanning Company discharges untreated industrial waste having an estimated population equivalent of 1,640, into the French Broad River. These wastes, being highly colored, discolor the stream, as well as add oxygen consuming materials.

Town of Brevard discharges the effluent from its treatment works into King Creek. This plant provides facilities for primary settling, sludge digestion, sludge drying, and chlorination (to prevent obnoxious odors during summer). The effluent has an estimated population equivalent of 2,925. The plant is adequate for present needs.

Transylvania Tanning Company discharges untreated industrial waste, having an estimated population equivalent of 3,328 into Tucker Creek. This waste is highly colored and oxygen consuming and results in nuisance conditions in Tucker Creek.

Ecusta Paper Corp. discharges untreated industrial waste into Davidson River. The plant provides primary treatment and sludge digestion for its domestic sewage. The population equivalent of the wastes from this plant, based on analytical data obtained at sampling station No. 13, is 249,000. These wastes are high in oxygen demand and reduce the dissolved oxygen in the French Broad River for a considerable distance downstream. Dissolved oxygen determinations run during the period July 22-September 20, 1954, show that the dissolved oxygen in French Broad River was rapidly depleted below the confluence of Davidson River. The above mentioned determinations show that the dissolved oxygen becomes zero and remains zero for a distance of approximately 20 miles. Conditions of zero dissolved oxygen seriously interfere with aquatic life.

Chipman LaCrosse Hosiery Mills Company discharges untreated industrial waste and domestic sewage into a small unnamed stream, hereinafter referred to as Dye Branch. This plant discharges approximately 80,000 gallons of highly colored waste daily that has a population equivalent of 1,570. This waste eventually enters Mud Creek.

Hendersonville discharges raw sewage and industrial waste through 13 outfall lines into Mud Creek. Raw sewage, being high in oxygen demand and in

coliform bacteria, renders the stream unfit as a source of water for irrigating vegetable crops and devoids the stream of dissolved oxygen. The importance of truck farming in Henderson County requires that the streams of the county be suitable for agricultural uses.

Cranston Printworks discharges untreated industrial waste, having a population equivalent of 8,400, into French Broad River. This waste, high in oxygen demand and color, adds to the pollution in an already grossly polluted stream.

Biltmore Dairy Farms discharge the untreated waste from its milk processing plant into French Broad River. This waste, having an estimated population equivalent of 9,000, further deteriorates the quality of the water in French Broad River.

American Enka Corp. discharges sewage and industrial waste into Hominy Creek. A part of the industrial waste receives some treatment by lagooning, whereas the remainder of the plant's waste goes to the stream untreated. The pH of the stream water, after receiving the plant wastes, fluctuates over a wide range. This waste renders the stream almost useless as a source of water for irrigation and seriously affects the stream biota.

City of Asheville and Buncombe County Sanitary Districts

There are nine public sewer systems in Asheville and the Buncombe County Sanitary Districts that are interconnected and dependent one upon another in conducting the raw sewage to the French Broad River and/or its tributaries. Cognizance of this interrelationship is essential in considering the sanitary sewer facilities in the area.

City of Asheville

Asheville, the largest city in western North Carolina, located in the center of the internationally famous mountain area, has an estimated resident population of 53,970 persons served by its sewage collecting system. Due to the importance of Asheville as a center of tourist activity, this sewer serves a substantially increased population during the tourist season, resulting in a substantial increase in sewage flow. This sewage, together with the industrial waste from some of the industries in the city, is discharged, without treatment, into the French Broad River or Hominy Creek.

The waste from part of West Asheville is discharged into Hominy Creek through four outfalls. The waste from the remainder of West Asheville is discharged into the French Broad River through twelve outfalls. All sixteen of these outfalls discharge untreated waste into the streams.

Sewers serving the Keilworth and Biltmore sections of the city are discharged into the Swannanoa Sanitary District sewer.

The waste from the main section of the city is discharged untreated into the French Broad River through twelve outfalls.

The sewers serving the Beaver Lake section of the city discharge into two Woodfin Sanitary District sewers.

The total waste load from the Asheville sewer system is estimated to have a population equivalent of 65,000. The major portion of this waste enters the river upstream from the city and contributes greatly to the pollution in an already grossly polluted stream.

All of the industrial waste discharged within the municipal limits of Asheville is not discharged into a public sewer system. Some of the industries, located along the French Broad River, discharge untreated industrial waste, through private sewer systems into the river. The industries contributing a significant amount of pollution by the above method are:

Hans Resse Tannery discharges untreated industrial waste into the French Broad River. This waste, having an estimated population equivalent of 28,800, is high in color as well as high in oxygen demand, and adds greatly to the pollution in a grossly polluted stream.

Asheville By-Products Company discharges untreated waste into the French Broad River. This waste is estimated to be equivalent in strength to raw sewage from a population of 920 persons.

Buncombe County Sanitary Districts

During the period 1923-1929, twelve sanitary districts were formed in Buncombe County to provide water or sewerage or both of these services in areas that were at that time outside the municipal boundaries of Asheville. Four of these districts installed both water lines and sewer lines, three installed water lines only, and the remaining five provided sewer lines. One of these sanitary districts has since been incorporated into the City of Asheville. Of the districts having water distribution system, only one has its own source of supply; the other districts being supplied by the Asheville water system.

As a result of legislation enacted by the North Carolina legislature, the Board of County Commissioners of Buncombe County is responsible for the maintenance of the sewers and water lines in all the sanitary districts except Woodfin.

The district sewer systems are briefly described as follows:

The Beaverdam Water & Sewer District discharges raw sewage from an estimated resident population of 1,000 persons into the Woodfin Sanitary District sewer.

The Busbee Sanitary Sewer District - Sewage from a population of about 200 persons is discharged, after receiving primary treatment followed by sand filtration, into Dingle Creek. Pollution in Dingle Creek is significant only insofar as it affects downstream uses.

Sewage from the remainder of the district, about 250 persons, is discharged without treatment into the Biltmore Forest Municipal Sewer System.

The Caney Valley Sanitary Sewer District discharges untreated sewage, from as estimated resident population of 800 persons, into the Asheville sewer system, which, in turn, is discharged into Hominy Creek.

The Crescent Hill Sanitary Sewer District discharges sewage, after receiving primary treatment, into Piney Creek. The sewer system serves an estimated population of 250 persons.

The Fairview Sanitary Sewer District discharges untreated sewage from an estimated population of 3,000 persons into the Swannanoa Sanitary District Sewer.

The Skyland Sanitary Sewer District discharges untreated sewage from an estimated population of 2,000 persons and waste from the International Resistance Company into French Broad River.

The Swannanoa Water and Sewer District discharges untreated sewage and industrial waste into the French Broad River. The Swannanoa outfall sewer carries sewage from the sanitary district, Ridgecrest (a private system), the municipal sewer system of Black Mountain, the Montreat Sewer System, (a private system), the Blue Ridge Y.M.C.A. Camp, the State Hospital, Black Mountain College, the Government Hospital at Swannanoa, the Government Hospital at Oteen, the Fairview Sanitary Sewer District Sewer System, and the sewer systems serving the Kenilworth and East Biltmore sections of the City of Asheville. The outfall sewer also carries the Sayles Biltmore Bleachery. The domestic sewage discharged by this outfall sewer is estimated to have a population equivalent of 20,000 and the industrial waste an estimated population equivalent of 15,000.

The Woodfin Sanitary Water and Sewer District discharges untreated sewage through twelve outfall lines into the French Broad River. The Woodfin System serves an estimated connected population of 6,000 persons, as well as discharging the waste collected by the Beaverdam water and sewer district system and a part of Asheville. The estimated population equivalent of effluent from this system is 9,000.

Biltmore Forest discharges untreated sewage through two outfall lines, one to the Swannanoa River and the other to the French Broad River. The outfall line to the Swannanoa River serves an estimated population of 400 persons; whereas, the outfall line to the French Broad River serves an estimated population of 600 persons as well as discharging a portion of the waste collected by the Busbee system. The population equivalent to the Swannanoa River is estimated to be 400 and the population equivalent to the French Broad River, including the Busbee waste, is estimated to be 850.

Gorham Mfg. Company discharges untreated industrial waste to French Broad River. Since this plant was beginning operations in 1954, information concerning the nature of this waste was not available.

Weaverville - The Weaverville Sewer System serves an estimated connected population of 800 persons and also collects the industrial waste from the Hadley Corp. This waste is discharged untreated into Reems Creek and has an estimated population equivalent of 1,050.

Mars Hill College discharges the effluent from its primary treatment plant into Gabriel Creek. This sewerage system serves an estimated population of 1,000 persons and discharges an effluent having an estimated population equivalent of 700.

Hammarlund Manufacturing Company discharges the waste from its metal plating room into a waste treatment plant. The metallic ions are precipitated and allowed to settle before the effluent is discharged into Banjo Branch. If this plant is properly operated and maintained, its effluent should not adversely affect the receiving stream.

Marshall discharges untreated domestic sewage from an estimated connected population of 745 persons into the French Broad River.

Hot Springs discharges raw sewage into French Broad River and Spring Creek. It is estimated that the system discharging into French Broad River serves an estimated population of 275 persons, while the system discharging into Spring Creek serves an estimated population of 440 persons.

Several schools in the area discharge waste either treated or untreated into the streams of the drainage system.

Red Oak School, Buncombe County, enrollment 266, discharges waste, after receiving primary treatment into Shepard Branch.

Barnardsville School, Buncombe County, discharges untreated sewage from an enrollment of 486 students into Ivy River.

Candler High School, Buncombe County, enrollment 1,213, discharges raw sewage into Hominy Creek.

Sand Hill High School, Buncombe County, enrollment 1,100, discharges raw sewage into Hominy Creek.

Walnut High School, Madison County, discharges raw sewage into Brush Creek.

White Rock School, Madison County, enrollment 647, discharges raw sewage into Shelton Laurel Creek.

Beech Gleen School, Madison County, discharges raw sewage into Little Ivy Creek.

Ebbs Chapel School, Madison County, discharges raw sewage into Laurel Creek.

Pigeon River and Tributaries - These waters are used for sewage and industrial waste disposal. Wastes are discharged into the drainage system at Canton, Clyde, Hazelwood, Waynesville, and Lake Junaluska. The sources of pollution are discussed below:

Town of Canton discharges untreated sewage into Pigeon River through six outfalls. The Canton sewer system serves an estimated population of 5,000 persons and contributes a major portion of the bacteriological pollution to the river.

Champion Paper and Fibre Company discharges industrial waste into Pigeon River that is estimated to be equivalent in strength to domestic sewage from a population of 624,000 persons. This waste, being highly colored as well as high in oxygen demand, reduces the dissolved oxygen in the stream to zero. Dissolved oxygen determinations run during the period July 21 - September 15, 1954, show that dissolved oxygen in Pigeon River was zero for a distance of approximately fifteen miles downstream. The absence of dissolved oxygen destroys the normal stream flora and fauna and results in the development of obnoxious odors.

Clyde discharges untreated sewage into Pigeon River from an estimated population of 150 persons. This waste is of significance only from the standpoint of adding pollution to an already seriously polluted stream.

Waynesville - Hazlewood - Lake Junaluska Outfall - An outfall sewer, owned jointly by the municipalities of Waynesville, Hazlewood, and Lake Junaluska, carries the domestic sewage and industrial waste collected by the municipal sewer systems to the Pigeon River. This outfall serves an estimated population of 9,000 persons and discharges untreated sewage and industrial waste that is estimated to be equal in strength to domestic sewage from a population of 26,290 persons. The A. C. Lawrence Leather Company, the Pet Milk Company and the McKay Abattoir contribute industrial waste that is estimated to be equal in strength to domestic sewage from a population of 17,290 persons, whereas the remainder of the load is contributed by domestic sewage from an estimated population of 9,000 persons. This waste adds to the color in an already badly discolored stream as well as adds a great amount of oxygen consuming materials to a stream that is already devoid of dissolved oxygen.

Dayton Rubber Company discharges cooling water and wash water to Richland Creek; however, soaps or detergents are not used in their washing process. Even though the volume of these waters is large, they have no deleterious effect on the receiving stream.

Rock Hill School, Haywood County, enrollment approximately 200, discharges raw sewage into Jonathans Creek. Jonathans Creek has been stocked with trout and designated as trout waters by the N. C. Wildlife Resources Commission. This waste is deleterious to fish life and should receive treatment before being discharged into the stream.

Fines Creek High School, Haywood County, enrollment 372, discharges untreated sewage into Fines Creek.

Nolichucky River and Tributaries - The mining industry is perhaps the greatest single user of surface waters in the area. Tremendous quantities of water are required to separate the earth from the minerals mined. These washings even though generally inert, have a deleterious effect on the receiving stream. The greatest effect of the washing operations is the result of an increase in turbidity eliminating sunlight and upsetting the fauna and flora of the streams. The effects of these wastes extend for a great distance downstream and have resulted in complaints from interested persons and agencies in the State of Tennessee.

Wastes, other than mine tailings, are discharged into the drainage systems at Newland, Spruce Pine, Burnsville, and Bakersville. The sources of pollution are as follows:

Town of Newland has an estimated sewered population of 125 persons. The town provides primary treatment for its waste. However, this plant was not being properly operated and maintained when inspected by personnel of the State Stream Sanitation Committee. It is doubtful that the treatment plant, as operated, reduces the waste load to the North Toe River.

Town of Spruce Pine discharges untreated sewage from an estimated population of 2,500 persons into the North Toe River. This waste, together with other materials already present in the stream, results in a reduction of the dissolved oxygen in the stream.

Town of Burnsville - The Town of Burnsville discharges untreated sewage from an estimated connected population of 1,500 persons into Little Crabtree Creek and Pine Swamp Branch. Little Crabtree Creek receives the sewage from approximately 1,000 persons, while Pine Swamp Branch receives the sewage from about 500 persons. Both of these streams are quite small; therefore, the wastes result in offensive conditions. These wastes should receive adequate treatment before being discharged.

Town of Bakersville - The Town of Bakersville has no public sewerage system; however, sewage from some homes as well as sewage from Bowman High School is discharged into Cane Creek. This stream has been stocked with trout and designated as trout waters by the N. C. Wildlife Resources Commission. Treatment of these wastes should be provided.

Robinson Dairy, Route #2, Burnsville discharges untreated waste into South Toe River. This waste has a strength that is estimated to be equal in strength to domestic sewage from a population of 250 persons.

Bald Creek High School, Yancey County, discharges waste from an enrollment of 700 into Bald Creek.

Bee Log High School, Yancey County, discharges waste from an enrollment of 600 students into Bald Creek. This waste receives primary treatment before being discharged.

Clearmont High School, Yancey County, discharges untreated waste from an enrollment of 600 into Jacks Creek.

Micaville High School, Yancey County, discharges waste from an enrollment of 800 students into Ayles Creek. This waste receives primary treatment before being discharged.

Other Contents of the Report - This information includes a summary (page 9), conclusions (page 11), general description of the French Broad River Basin (pages 15 and 16), economic development (pages 17-25, inclusive), general survey findings (pages 29-34, incl., 149-152, incl., and 191-193, incl.), public and industrial water supplies (pages 55, 161, and 203), analytical results, and recommended classifications, in addition to maps and graphs.

Further Action by the State Stream Sanitation Committee - After consideration of views and comments presented at the public hearing previously indicated in this chapter, the Committee will adopt classifications of waters in the French Broad River Basin and determine the effective date thereof, on and after which the provisions of Section 143-215.2, General Statutes of North Carolina, will be in full force and effect.

CHAPTER X - WATERSHED MANAGEMENT

General - Information regarding water control; problems of watershed management; the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 2nd Session, approved August 4, 1954); the first annual National Watershed Congress (December 6 and 7, 1954); and the North Carolina Soil Conservation Districts Law, enacted by the 1937 Session of the General Assembly, may be found in Chapter XIII of "Water Resources of North Carolina, Department of Conservation and Development, 1955". The quoted publication comprises Volume I of a series of 11 volumes pertaining to the Water Resources of the State, of which the material herein, regarding the water resources of the French Broad River Basin, forms Volume VI.

Soil Conservation Practices Accomplished and Contemplated - The data contained in the following tables of "Soil Conservation Practices Accomplished" and "Soil Conservation Practices Contemplated" were furnished by the State Conservationist, Soil Conservation Service, U. S. Department of Agriculture, Raleigh, North Carolina, for the eight counties lying wholly or partially within the French Broad River Basin. Each of these counties comprises a soil conservation district. This situation is different from other North Carolina river basins in which two or more counties are included in a soil conservation district.

The large number of "remaining district cooperators", shown on the table of Soil Conservation Practices Contemplated, does not necessarily signify an unwillingness on the part of farmers in those counties to carry out conservation plans. On the other hand, it simply means that the small number of Soil Conservation Service technicians available in North Carolina have been unable thus far to work with all of these farmers. The State Conservationist hopes to reach them all as rapidly as possible.

Watershed Protection and Flood Prevention - No work under the Provisions of Public Law 566, 83rd Congress, approved August 4, 1954 (see page 103, "Water Resources of North Carolina, Department of Conservation and Development, 1955"), as of April 23, 1956, was in progress in any of the eight counties lying wholly or partially within the French Broad River Basin in North Carolina. However, applications for planning assistance have been submitted to the Administrator of the Soil Conservation Service for two watersheds, Mud Creek and Cane Creek. Mud Creek Watershed is wholly in Henderson County, while Cane Creek Watershed is partially in Buncombe County. Both of these watersheds have been approved by the State Soil Conservation Committee (see page 119, "Water Resources of North Carolina, Department of Conservation and Development, 1955"), and Mud Creek Watershed has been designated for planning by the Administrator of the Soil Conservation Service. The watershed work-planning party, Office of the State Conservationist, as of April 23, 1956, was in the process of gathering data and information which would enable the party to work out with local interests a work plan which would be satisfactory to all parties concerned.

SOIL CONSERVATION PRACTICES ACCOMPLISHED

ITEM	UNIT	AVERY	BUNCOMBE	HAYWOOD	HENDERSON	MADISON	MITCHELL	TRANSYLVANIA	YANCEY	TOTAL
Closed Drains	Lin.Ft.	7,755	39,595	4,830	18,349	9,237	13,188	49,800	28,176	170,930
Conservation Crop Rotation	Acres	312	7,417	3,107	608	547	1,875	2,565	7,734	26,165
Contour Farming	Acres	323	1,276	1,176	1,040	1,511	6,275	- -	8,627	20,227
Contour Stripcropping	Acres	145	338	273	112	108	1,200	- -	1,379	3,555
Cover Cropping	Acres	208	1,342	2,365	1,320	2,185	1,118	415	1,013	9,966
Critical Area Planting	Acres	- -	1,455	690	11	- -	2	- -	- -	2,158
Crop Residue Utilization	Acres	102	5,797	3,414	1,149	1,528	544	4,150	3,578	20,262
Drainage	Acres	202	441	107	323	996	340	415	1,855	4,679
Group Enterprise	Miles	- -	- -	- -	- -	- -	- -	- -	- -	- -
Group Enterprise	Cu.Yds.	- -	- -	- -	- -	- -	- -	- -	- -	- -
Improvement Cutting	Acres	14	560	2,443	333	- -	1,054	- -	5,293	9,697
Open Drains	Miles	202	25	10	7	5	5	2	19	270
Open Drains	Cu.Yds.	15,304	135,311	50,500	49,171	275	23,000	16,600	1,500	291,661
Pasture Planting	Acres	367	4,818	200	1,890	15,002	1,326	4,150	5,269	33,022
Pond Construction	No.	12	55	2	28	6	16	16	29	165
Sprinkler Irrigation Systems	No.	- -	49	1	4	12	4	7	5	82
Sprinkler Irrgiation Systems	Acres	- -	496	1	255	100	72	166	25	1,115
Terracing	Miles	- -	- -	- -	1	- -	- -	- -	- -	1
Tree Planting	Acres	43	2,167	300	87	16	2,745	498	1,046	6,902
Waterway Development	Acres	- -	59	1	44	1	- -	25	28	158
Wildlife Area Improvement	Acres	9	25	2	51	- -	29	- -	20	136
District Cooperators	No.	142	304	119	217	49	323	10	176	1,340

SOIL CONSERVATION PRACTICES CONTEMPLATED

ITEM	UNIT	AVERY	BUNCOMBE	HAYWOOD	HENDERSON	MADISON	MITCHELL	TRANSYLVANIA	YANCEY	TOTAL
Closed Drains	Lin.Ft.	14,386	3,788,273	699,450	193,751	360,363	42,812	697,200	51,824	5,858,059
Conservation Crop Rotation	Acres	4,320	18,401	11,688	14,099	16,042	6,410	8,964	6,169	86,073
Contour Farming	Acres	3,219	6,879	7.409	10,854	13,908	6,379	4,524	8,704	61,876
Contour Stripcropping	Acres	2,944	11,246	6,647	9,394	5,792	7,510	996	12,429	56,958
Cover Cropping	Acres	4,317	9,519	9,630	13,544	2,284	1,115	1,660	827	42,896
Critical Area Planting	Acres	- -	1,835	10,762	1,039	- -	100	83	- -	13,819
Crop Residue Utilization	Acres	2,838	19,201	10,761	19,925	17,564	1,591	6,964	5,485	84,329
Drainage	Acres	634	9,349	4,083	4,829	2,974	980	4,565	965	28,379
Group Enterprise	Miles	- -	- -	- -	- -	- -	- -	- -	- -	- -
Group Enterprise	Cu.Yds.	- -	- -	- -	- -	- -	- -	- -	- -	- -
Improvement Cutting	Acres	475	14,066	111,557	40,310	113,565	28,653	9,130	43,649	361,305
Open Drains	Miles	18	121	78	151	30	12	7	10	427
Open Drains	Cu.Yds.	20,074	898,689	389,500	1,000,829	209,725	60,000	83,000	24,900	2,686,717
Pasture Planting	Acres	3,448	27,547	43,885	9,342	40,438	10,284	4,103	16,254	155,301
Pond Construction	No.	49	216	101	18	390	68	50	26	918
Sprinkler Irrigation Systems	No.	- -	1,031	400	23	323	15	76	18	1,886
Sprinkler Irrigation Systems	Acres	- -	10,307	299	302	2,460	122	2,324	310	16,124
Terracing	Miles	- -	- -	- -	21	- -	- -	8	- -	29
Tree Planting	Acres	2,237	9,397	12,000	5,465	32,294	13,800	4,150	9,965	89,308
Waterway Development	Acres	- -	772	19	54	40	100	25	307	1,317
Wildlife Area Improvement	Acres	77	516	42	194	455	250	87	473	2,094
District Cooperators	No.	734	3,706	2,665	1,459	3,409	1,608	896	2,564	17,041

Examinations and Surveys of the French Broad River Basin in North Carolina by the Corps of Engineers

House Document 1071, 62nd Congress, 3d Session - The Chief of Engineers, in his report dated October 17, 1912, concurred in the report of the Board of Engineers for Rivers and Harbors, summarized as follows: Between 1876 and 1882, appropriations aggregating $43,000 were applied to open channel works on certain sections of the French Broad River in North Carolina, and, while this work gave somewhat improved conditions, it appears that but little if any use was made of it, and the work was abandoned.

It appears that the 42 miles of river below Asheville, with the adjoining 32 miles in Tennessee as far down as Leadvale, has a total fall of about 1,000 feet. Obviously, it is useless for navigation and could be improved only by an extensive system of locks and dams, the cost of which would be prohibitive. This section forms a barrier between the partially navigable section above, and the part under improvement below, Leadvale. There remains for consideration only the stretch of 60 miles of river above Nashville. Parts of this stretch appear to be suitable for very light navigation, but other parts are badly obstructed by rock ledge, and the district engineer believes that the feasibility of a satisfactory improvement of the portion from Big Buck shoals to Asheville by any other method than the construction of locks and dams is extremely doubtful. The upper 12 miles of the river is little more than a creek, and the district engineer does not believe that this portion could be considered as capable of improvement for navigation.

The local demand for the improvement of the river appears to be based on a desire for betterment of flood conditions rather than the need for commercial navigation. In the opinion of the board, the benefits to be expected would be clearly incommensurate with the large expenditure required to effect a useful improvement. It therefore concurs with the district officer and the division engineer in the opinion that it is not advisable for the United States to undertake the improvement of the French Broad River in the State of North Carolina.

House Document No. 319, 67th Congress, 2d Session - The report of the District Engineer, dated January 15, 1921, contains the following information regarding the French Broad River in North Carolina:

A problem is presented on this river in the region above Asheville in the general vicinity of Brevard and Hendersonville, N. C., where the river banks are very low and where the river frequently does much damage to crops by overflow. It is in this section of the river that the Government, between 1877 and 1885, expended about $40,000 in the construction of spur and wing dams in the interest of navigation. These works, it is claimed by residents of this region, have restricted the area of the river channel and thus caused overflows to be more frequent and banks to cave in and wash away. The condition appears to be one which should properly receive careful consideration in connection with the river system as a whole. The section of the river in the vicinity of and above Asheville has been visited by several severe floods, the last and possibly most disastrous of which occurred in July 1916, when the river rose to about 21 feet in Asheville, destroying and damaging much property including dams, bridges, industrial plants, etc. These floods extend, of course, throughout the length of the river, but apparently do not cause as great loss on the upper reaches, though the damage to crops, etc., is not inconsequential. . .

The District Engineer, in his report, referred to the river and harbor act of June 5, 1920, which authorized a preliminary examination of the French Broad River in North Carolina. The report of this examination, which was made on October 13, 1920 and which has not been printed, recommended that further action be deferred until it can be taken as a part of the general survey of the Tennessee River, authorized by the act of June 5, 1920. The report was returned to the District Engineer by the Chief of Engineers with instructions to cover this item coincident with report on Tennessee River and tributaries called for by the act.

The report of the District Engineer, dated January 15, 1921, in addition to the French Broad River, discussed the following streams:

Tennessee River - Chattanooga to Florence.
Tennessee River - Florence to Paducah.
Clinch River and Tributaries.
Holston River and Tributaries.
Little Tennessee River and Tributaries.
Richland River, Tennessee.
Hiwassee River and Tributaries.
Sequatchie River, Tennessee.
Gunters Creek, Alabama.
Paint Rock River, Alabama.
Elk River, Tennessee and Alabama.
Bear Creek, Alabama and Mississippi.
Beech River, Tennessee.
Duck River, Tennessee.
Big Sandy River, Tennessee.

It is recommended that a survey be made of the Tennessee River and its tributaries in the States of North Carolina, Tennessee, Alabama, and Kentucky, for the purpose of formulating a plan of navigation on these streams in which just weight could be given to every locality to the effect which existing or proposed river improvements in that locality will have on any proposed project for the entire river system. The report also recommended that, in making this study, there be included studies of present or potential hydroelectric developments, the mineral and industrial resources of this basin, floods, drainage, and other allied subjects.

The Chief of Engineers, on May 16, 1922, recommended that an appropriation of $250,000 be made for continuing the work and that the full amount for completing the survey, viz, $515,800, be authorized.

House Document No. 463, 69th Congress, 1st Session - - The report of the District Engineer, dated May 22, 1926, contains the following information regarding the French Broad River and its tributaries in North Carolina:

Big Pigeon River

This river has been mapped by the survey from Canton, North Carolina, to its mouth. The Cataloochee-Waterville project has been formulated by the Pigeon River Power Company as a permittee under the Federal water power act, and this company is now an applicant for a license to construct this project. Much of its investigation was done here before the governmental survey for this river was authorized. The complete study of the mapped section is on the survey program but has not yet been reached. In addition to the pending project, the survey recognizes the following possibilities as worthy of careful study.

A favorable dam site can probably be found on the Big Pigeon immediately below the mouth of Jonathan Creek, Jonathan site, or at some point between that site and the head of the reservoir formed by the project dam in the Big Pigeon immediately below the mouth of Cataloochee Creek. Such a dam should form a reservoir having a maximum surface elevation at about 2,580 feet above sea level, about 2,220 feet above tailwater of the Interstate dam below Riverton on the Tennessee, and about 320 feet above the Cataloochee Reservoir. The Jonathan Reservoir should have an available storage capacity of about 250,000 acre-feet. It involves the overflow of good farm land, concrete highways, railroads, and some small villages. The area of the reservoir would be about 6,800 acres. It would form an artificial lake lying immediately adjacent to the eastern boundary of the proposed Great Smoky Mountain National Park, it would be close to the nationally known tourist city of Asheville, and would be surrounded by the high mountain peaks of that section. For this reason, its scenic value should be appreciable.

Below Waterville, the Big Pigeon descends about 400 feet before joining the French Broad. Favorable dam sites for the development of about the first 250 feet of this descent as a power head should be located without difficulty. A declaration of intention for one dam in this section is now on file before the Federal Power Commission. No specific sites have as yet been fixed by the survey or other agency. It is hoped that the survey study of the lower 150 feet of fall will disclose feasible power projects. In this lowest section, the results can not yet be predicted with assurance.

The Jonathan Reservoir would add about 480 cubic feet per second to the minimum low-water flow through the Cataloochee-Waterville plants, which develop a head of about 800 feet, and to such additional plants as may later be found feasible on the lower Big Pigeon and the Lower French Broad . . .

French Broad

This river has been mapped by the survey from Brevard downstream to a point below the junction of the Big Pigeon, and maps to its junction with the Tennessee River will be completed at an early date. The complete study of the mapped section is on the survey program, but has not yet been reached. The following possibilities are recognized as worthy of careful study.

A favorable dam site can probably be found on the French Broad about 3 miles above the city of Asheville, the Asheville site. A dam here should form a reservoir having a maximum surface elevation of about 2,100 feet above sea level, about 1,750 feet above tailwater at the Interstate Dam, and about 1,300 feet above the pool of the Coulter Shoals Dam below Knoxville on the Tennessee. A head of about 130 feet could be obtained at the Asheville Dam. In the next 70 miles downstream, the river descends about 1,000 feet. Power should be developed at the dam. Throughout the 70-mile stretch with its 1,000 feet fall, the river is closely paralleled by a railroad located but a short distance above the high-water line. With flood discharge reduced by the Asheville reservoir storage above, it is hoped that, by a series of low dams, some tunnels, and flumes, most, if not all, of this head may be utilized for power without undue interference with the railroad. No other feasible scheme for the elimination of this railroad as an obstacle to power development has yet been suggested . . .

The Asheville Reservoir should have an available storage capacity of nearly 1,000,000 acre-feet . . . It would have an area of over 30,000 acres, and the flowage damages caused thereby would doubtless be more than could be borne by the power developed at the 130-foot dam creating it. If it can be given due

credit for the benefit which it would contribute to plants on the Tennessee River at Coulter Shoals, Marble Bluff, White Creek, Soddy, Sherman, Hales Bar, Guntersville, No. 3, Wilson Dam, and Interstate, it is hoped that its cost can be justified. This reservoir would form a lake having a sufficient depth for navigation extending from Asheville to Hendersonville and to near Brevard. It would be surrounded by the mountains which have helped to give this region a national reputation as a tourist center. It is believed that this scenic setting and local navigation would have an appreciable value. This region suffered from a water famine in 1925. With this reservoir, no such famine could occur. These facts warrant the survey which will be made of this region.

Under the authority as extended by the act of April 15, 1926, the survey will also include the Little Pigeon River and Big Creek.

Nolichucky

Under the authority as extended by the act of April 15, 1926, the survey will include North Toe River, South Toe River, Cane Creek, and the Nolichucky above Embreeville (Tennessee). Declarations of intention are on file with the Federal Power Commission for power development in the region which includes the streams indicated above.

The District Engineer's report, dated May 22, 1926, was prepared in accordance with instructions from the Chief of Engineers. In his letter of June 24, 1926, forwarding the report to the Speaker of the House of Representatives through the office of the Secretary of War, the Chief of Engineers emphasized the fact that the report is purely and simply a progress report, to keep Congress advised of the small letter-status of the matter and to make possible, under the provisions of the act of April 15, 1929, the giving of appropriate information to interested private parties.

House Document No. 185, 70th Congress, 1st Session - This publication comprised a second progress report on the survey of the Tennessee River and its tributaries in the States of North Carolina, Tennesse, Alabama, and Kentucky. It was submitted by the District Engineer on December 23, 1927 and forwarded to Congress by the Chief of Engineers on February 23, 1928. It contains information regarding existing navigation projects, existing power projects, the status of flood control at that time, methods of regulation of stream flow and power, benefits which might be obtained from regulation of stream flow and power, present and possible development of navigation, and present and possible development of flood control. It contains cost estimates of navigation, water power, and flood-control projects in the Tennessee River Basin, none of which would be located in North Carolina. The report stated that the total cost of these projects would be over one billion dollars.

Other Examinations and Surveys - Information regarding the completion of the survey of the Tennessee River and its tributaries in the States of North Carolina, Tennessee, Alabama, and Kentucky is not available. Presumably, it was made available to, or completed by, the Tennessee Valley Authority after its creation by Congress.

Flood Control Plan for the French Broad River Basin - The Chairman of the Board, Tennessee Valley Authority, submitted to the President of the United States, on January 12, 1950, a report entitled "A Flood Control Plan for the French Broad Valley". Extracts from this report follow.

The plan provides for flood control only, differing in this respect from

most of the projects built by the TVA. Most of the TVA projects so far constructed serve the multiple purposes of navigation, flood control and power production.

The TVA water control system includes the following dams in North Carolina:

Name	Location	River
Appalachia	Cherokee County	Hiwassee
Hiwassee	Cherokee County	Hiwassee
Chatuge	Clay County	Hiwassee
Santeetlah	Graham County	Cheoah Creek
Cheoah	Graham-Swain County Line	Little Tennessee
Fontana	Graham-Swain County Line	Little Tennessee
Nantahala	Macon County	Nantahala
Glenville	Jackson County	Tuckasegee

The only dam, on the French Broad River, in the TVA water control system is Douglas Dam, about 10 miles southwest of Dandridge, Tennessee.

Although the intense storms in the upper French Broad Basin, at times, cause high rates of discharge for brief periods, the total usable runoff from that part of the watershed is not sufficient to justify, under any conditions now foreseeable, the additional cost of structures which would be needed for the generation of power. Because of these factors, nothing more than detention basins and the accompanying works for flood control alone are economically feasible above Asheville.

The French Broad Valley is one of a number of important areas in the Tennessee Valley which are subject to recurring flood damage and which, because of limitations of terrain, stream flow, or existing development, call for works designed solely for flood control rather than projects that would serve other purposes also.

History - In recent years, the upper French Broad Valley experienced very damaging floods in 1940 and 1949. In 1940, two floods caused damage totaling $1,800,000, of which $235,000 was damage to crops in the French Broad Basin above the mouth of the Swannanoa River. In the summer of 1949, there were three floods which caused damage in the amount of $1,350,000. Of this, $1,220,000 was damage to crops despite the fact that the floods were much lower in stage than those in 1940. The greater damage to crops was due to the fact that, in some cases, three separate plantings were destroyed and because truck farming had increased markedly in the area during the intervening years.

Following the damaging floods of August 1940, an organization was created, under the name of the Western North Carolina Flood Control Committee, to obtain protection from floods on the upper French Broad River and its tributaries. This committee, composed of representatives in every county of the area, petitioned TVA to investigate the situation and determine whether it was feasible to control these floods.

In August 1942, TVA issued a preliminary report which set forth a plan for control of floods by a levee at Asheville and seven detention basins, the flow from which would be controlled by gates. Further study showed that operating costs could be considerably reduced by substituting fixed-size outlets for the gates, at the dams, and that more reliable protection could be given the agricultural lands in the lower part of the valley above Buck Shoals, about two miles southwest of Skyland, Buncombe County, by supplementing such basins with

channel dredging and levees along the river.

Accordingly, final study of the problem was started on this basis. Foundation exploration by drilling started in the fall of 1944 as soon as war conditions permitted, but uncertainty about price levels made it inadvisable to initiate construction. The peak of prices seems to have been reached in 1948 when the estimates included in the report to the President were developed.

Some time may elapse before printed copies of the report are available. In the meantime, this folder is intended to serve as a source of general imformation concerning the proposed plan.

The Flood Control Plan - Some measure of protection from flood damage in this area could be afforded by (1) the construction of detention basins, or by (2) enlargement and improvement of stream channels and construction of levees. However, studies of the problem show that, on the upper French Broad, neither detention basins nor channel basins alone would afford a reasonable degree of protection. The great quantities of water to be handled during floods make it physically impossible to build detention dams large enough to protect the areas involved. The only feasible method appears to be a combination of detention basins and channel improvements. Such a combination would hold back flood water from the principal tributaries until the water from heavy rains along the main river and the smaller streams had been discharged downstream.

Accordingly, TVA proposes seven detention basins. The dams forming these basins would be located as follows:

Swannanoa River near Azalea, Buncombe County.
Cane Creek about one mile from the Asheville-Hendersonville Airport, Henderson County.
Clear Creek near its junction with Mud Creek in Henderson County.
Little River about one mile south of Penrose, Transylvania County.
French Broad River Between Brevard and Rosman, Transylvania County.
Davidson River above N. C. Highway 280, Transylvania County.
Mills River below the junction of Rocky Fork and South Fork, Henderson County.

These basins, acting alone, could not prevent overflows farther downstream. The main channel of the French Broad River would have to be improved from Buck Shoals to the mouth of Willow Creek, about four miles southwest of Horse Shoe, Henderson County. In addition, some channel improvement work would be necessary in the lower ends of Mills River, and Cane and Mud Creeks, which do not have sufficient discharge capacity.

Costs and Benefits - - The estimated cost of the entire plan, based on present-day construction costs and on the assumption that the costs of right-of-way and damages to be taken care of by local agencies would be the same as though these features were handled by the Federal Government, is $21,500,000. Of this sum, it is estimated that Federal costs would be $20,730,000.

The estimated average annual charges for the flood control system are $611,000 (interest, $434,000; depreciation and amortization, $107,000; and operation and maintenance, $70,000). The estimated average annual benefits are at least $794,000. This provides a ratio of annual benefits to annual costs of 1.3 or $1.30 in benefits to each $1.00 of costs.

Operation of the System - The dams proposed in this plan would have perm-

anent outlet openings through the base with no gates. The size of these openings would be proportioned to the capacity of the improved river channels downstream; hence, the operation would be entirely automatic.

Water would be stored in a basin only when the inflow during a flood is greater than the discharge capacity of the outlet. As soon as the flood flow becomes less than the capacity of the outlet, the basin would begin to empty . . .

With this method of operation, flood waters that now inundate large areas below the dams would be held off these areas by only a small increase in the acreage which is naturally flooded within the detention-basin areas. Within the basin, only the bottom lands nearest the dams would ordinarily be affected by storage of flood waters. Additional land in the upper end of the basins would be affected only during floods as great as, or greater than, the greatest known floods in the area - those of April 1791 and July 1916. In most years, the greater part of the crops within the basins would suffer no damage.

It would not be economically feasible to make the channels below the dams of sufficient capacity to carry all the flow in a flood like that of 1916, which has occurred only twice in 160 years. However, even in such a flood, the stages along the river below the dams would be much lower than under natural conditions, and the area of land flooded would be substantially less than was actually flooded in 1916.

In a recurrence of the 1940 or 1949 floods, somewhat more land would be inundated above the dams than was actually flooded in those years, but in each of the three counties affected, Buncombe, Henderson, and Transylvania, several times as great an area would be saved from flooding below the dams. Moreover, the land saved from flooding is part of the most valuable bottom land, while much of the land, flooded within the basins by reason of the detention dams, lies at higher elevations along the margins of the valley and is less valuable for agriculture .. .

The suitability of the lands in the detention basins for continued use is shown by experience in five detention basins of the Miami Conservancy District near Dayton, Ohio, where all the land within the basins has been sold back to private ownership, subject to the necessary flowage rights, and is farmed.

Alternative Plans - Since, as previously stated, neither detention basins nor channel improvements alone would solve the problem, the only alternative to the plan proposed by TVA would be a change in the extent to which detention basins or channel improvements are used. It has been suggested that the detention basins be located farther upstream on the tributaries with more extensive dredging of channels in the areas that would thus be left unprotected by the detention basins. This suggestion was made with a view to locating the dams so as to include less cultivated lands in the basin.

TVA investigated this possibility extensively. It considered a greater number of detention dams farther upstream on the tributaries. The alternatives proved not only more expensive but less workable. The difficulty with any such plan is that the runoff from a much larger area is left uncontrolled. Intense rainfall on the uncontrolled area must go into the channel or overflow on the land. To avoid overflows, the capacity of the channel would need to be increased. Increasing channel capacity beyond the extent provided in the TVA plan might protect the land immediately adjacent but would rush the water onto other areas downstream. The net effect of greatly enlarged channels, with limited benefit from detention basins, is to increase floods downstream and to destroy permanently much of the valley because of the additional land occupied by enlarged river

channels and levees, both at cost greater than the benefits such a system would afford. It is, of course, true that the detention basins will at times flood valuable croplands above the dams. TVA found no feasible alternative which would protect as much valuable crop land downstream from the dams, while flooding so little in detention basins.

In any plan recommended by TVA, the benefits must substantially exceed the cost and the plan must be one that will accomplish without question the results contemplated. Studies clearly demonstrate that any plan to be economically feasible must consider the entire basin and that no one element can be omitted from the proposed plan if it is to operate successfully. There are not sufficient benefits on any one tributary or on the main stream to justify the cost of protecting any one particular area alone.

Acquisition of Land for Detention Basins - To avoid continuing claims and disputes concerning crop losses and other damages in the basin, TVA would either purchase the land outright where this method seems preferable or acquire an easement to permit overflow of the land. Although houses and other buildings must be removed from below the maximum possible water level in the basins, most of the land would be left in private ownership and under cultivation subject to flooding rights.

Local Cooperation Required - In accord with existing Federal policy for flood control works like those proposed, before Congress is asked to appropriate funds to begin construction, satisfactory assurances must be had from responsible agencies that they will provide the necessary lands, rights-of way, and easements for the construction of levees and channel improvements without cost to the United States, and that they will protect the Federal Government against claims for damages occasioned by the construction of the levees and channel improvements. In the case of dams and detention basins, the Federal Government normally provides all lands and rights-of-way in addition to the costs of construction. Because of the interdependence in this plan of the dams and the levees and channel improvements, it is proposed that the costs of operation and maintenance of the levees and channels as well as the dams and detention basins be borne by the Federal Government.